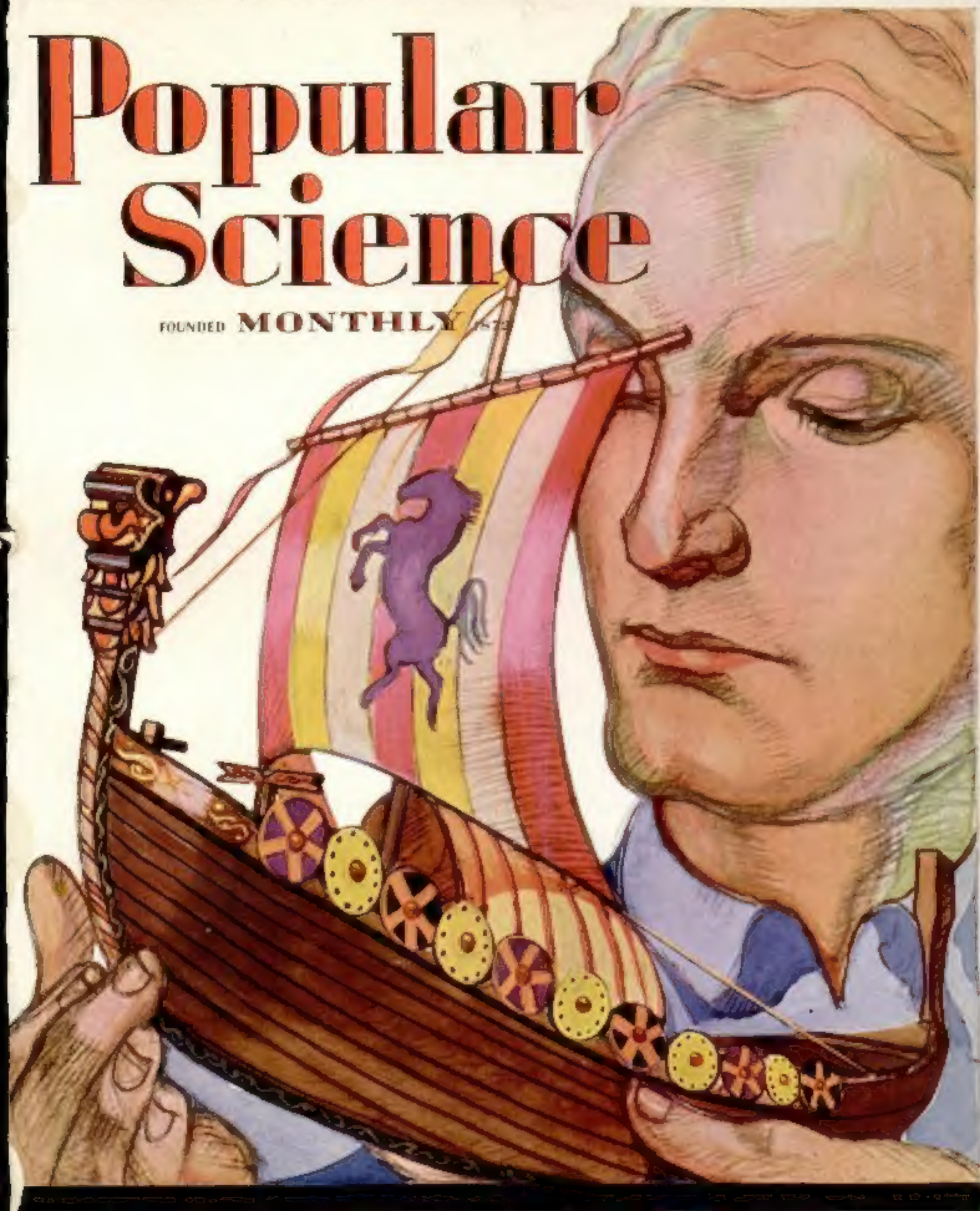


MAGAZINE OF NEW DISCOVERIES AND USABLE IDEAS

Popular Science

FOUNDED MONTHLY 1872



A PICTURESQUE VIKING SHIP MODEL

APRIL ANYONE CAN BUILD — PAGE 70 25 CENTS

BY AIRPLANE OR MULE-BACK

There's a radio station in Honduras, six thousand feet high, upon a mountain top. They use Radiotrons there, high power Radiotrons, for transmission. More than once in an emergency, the Radiotrons have had to be delivered by airplane. Usually they are carried up the rough mountainside by mule-back.

These great Radiotrons cost a few hundred dollars apiece, and as not many "spares" can be kept on hand at that price, each one must perform exactly to standard—each one must be sturdy of build in spite of its delicate accuracy.

The laboratories that design these high power transmission tubes design the Radiotrons you use. The same factories make them. The same test laboratories test them. RCA produces the tubes for all sorts of high power transmission and learns from these tubes many a lesson of making and testing that gives you a better Radiotron for your receiving set! Benefit from this experience by using only genuine RCA Radiotrons, no matter what type of tube you use.



RADIO CORPORATION
OF AMERICA
New York — Chicago
— San Francisco



Every tube in your set counts!

Every tube in your set has its "finger in the pie." The faint signal that comes in from the broadcasting station goes through each tube, and it's magnified hundreds of thousands of times before it gets to the loudspeaker.

It's not only important to get the "special" Radiotrons that give you bigger distance and bigger volume. But it's just as important to stick to genuine Radiotrons straight through the set, if you want to keep up its performance. RCA research makes Radiotrons better and better every year!

Bring your storage battery set up-to-date with
a power RADIOTRON UX 171 or UX 131
a detector RADIOTRON UX 200-A
and RADIOTRONS UX 201-A for all-round quality.
Bring your dry battery set up-to-date with
a power RADIOTRON UX 120
and RADIOTRONS UX 100 for all-round quality.

RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA

Before you buy a used car from a friend—

Send for
**THIS
FREE
BOOK!**



Pledge to the Public on Used Car Sales

- 1 Every used car is conspicuously marked with its price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.
- 2 All Studebaker automobiles which are sold as **CERTIFIED CARS** have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.
- 3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

To the Public: We pledge adherence to the above policy in selling used cars.

Your Studebaker Dealer

IF you were about to buy a used car from a friend, would you know how to determine its fair market price? Do you know why some dealers mark their prices in code instead of plain figures? Do you know how to tell what year any used car was built?

You will find the answer to these questions and many others that any buyer of a used car should know in this free book, "How to Judge a Used Car." It tells you what to look for and what to avoid in purchasing a used car. It is based on the long experience of experts in buying used cars for Studebaker dealers—their sound, practical advice may be the means of saving you time and money. Send for it at once!

Studebaker is only too glad to help you get the greatest value in a used car for your investment. Because Studebaker dealers believe in this policy, they have adopted this famous Pledge. Wherever you see this Pledge displayed you can buy a Certified Studebaker with absolute assurance that it is worth what the dealer asks and will do what he says.

THE STUDEBAKER CORPORATION OF AMERICA
Department D56, South Bend, Indiana
Please send my copy of valuable free booklet, "How to Judge a Used Car."

Name _____
Street _____
Town _____ State _____

Mail this coupon for your copy
of "How to Judge a Used Car"

S T U D E B A K E R



THEN AND NOW

AN EDITORIAL

THE other evening I was talking with an old friend. Some twist in the conversation recalled our school days. We began to compare ourselves as we were then with our sons and daughters of today.

"What beats me," said my friend, "is that my youngsters really seem to enjoy going to school. Remember how we used to hate it? Remember how we'd rig up all kinds of excuses to stay home, from headaches to torn trousers? But now you can't keep children away from school.

"I wonder if it's because the folks who run the schools have learned how to dress those dry examples, rules and dates in an interesting way? We used to get our knowledge like parrots, without knowing what half of it was about. But now the kids seem to soak it up as easily as playing a game."

Then, a few days later, there came to my desk a letter from a new reader in San Jose, California.

"POPULAR SCIENCE MONTHLY is to me the most interesting magazine in the world," he wrote. "I can remember, not so long ago, when I shied at the very word science. To me, and to a lot of others, it suggested ill-smelling rooms, men with long beards and mouthfuls of meaningless terms. But you have changed all that for me, by telling the scientist's story in terms I could understand."

SCHOOLROOMS transformed from drab prisons of learning to fascinating places of enjoyment! Science, dry and technical, made interesting, understandable—a living inspiring thing! The same basic idea, the same kind of purposeful effort brought about both of these changes.

Month after month it is the effort of the editors of this magazine to strip away the dull cloak which once surrounded science and reveal its true charm and simplicity, its glamor, its romance and its enormous daily value to you and me. It is our purpose to make each issue better than the last.

And when, in last month's issue, we expanded our editorial plan to include fiction for the first time, we were interested to learn how our readers would greet the innovation. The response, as expressed in hundreds of enthusiastic letters already received, was beyond all expectations.

"**G**IVE us more stories like 'Midge,'" wrote one man from Ohio. "For the first time in my life I can experience the thrill of a big steel plant."

Another, a Texan, wrote: "If the next installment of 'Bare Hands' is as absorbing as the first, we'll need a copy of the magazine for every member of the family."

Hundreds of other letters like these have justified our belief in this entirely new and different way of presenting the great drama of science.

If you did not read the first installment of Hawthorne Daniel's new novel, you can begin it now on page 36. And you won't want to miss Captain Dingle's delightful short story, "Tishy," on page 14.

These, with many timely articles describing new achievements, discoveries and useful ideas, will, we believe, bring the whole tremendous story of science to you in a more enjoyable and worth while way than ever before.—E. C. W.

Silent, permanent
radio power
from the light socket



with Balkite "B" and the new Balkite Trickle and High-rate Charger



Balkite Trickle Charger \$10

For those who require a charger of limited capacity only. Over 350,000 in use. Charging rate 5 amperes. Price \$10. West of Rockies \$10.50. (In Canada \$15.)



Balkite Combination

When connected to your "A" battery supplies automatic power to both "A" and "B" circuits. Controlled by the filament switch already on your set. Entirely automatic in operation. Serves any set now using either 4 or 6-volt "A" batteries and requiring not more than 30 milliamperes at 135 volts of "B" current—practically all sets of up to 8 tubes. Price \$59.50. (In Canada \$83.)

All Balkite Radio Power Units operate from 110-120 volts AC current with models for both 60 and 50 cycles. The new Balkite Charger is also made in a special model for 25-40 cycles.

Over 1,000,000 radio set owners are now using Balkite Radio Power Units because they provide silent, permanent power from the light socket. They are noiseless in operation and can be used during reception. They employ no tubes. They have nothing to wear out or replace. They are built to conform with the Underwriter's standards. Other than a slight current consumption their first cost is the last. Permanent and unfailing in operation, they are based on the same Balkite principle now commonly used in railway signaling, hospital lighting, and numerous other systems where power must be infallible.

One way of equipping your radio set with Balkite is to merely add Balkite "B" and the Balkite Trickle and High-Rate Charger. Balkite "B" eliminates "B" batteries entirely and supplies "B" current from the light socket. It is the proved popular "B" power supply. Of the 150,000 now giving satisfactory service, some of which have been in use for over three years, to our knowledge not

one has ever worn out. The new Balkite "B"-W serves sets of 5 tubes or less requiring 67 to 90 volts, Balkite "B"-X (shown above) sets of up to 135 volts and 8 tubes and Balkite "B"-Y any standard set. Most owners of even small sets will buy Balkite "B"-X which will take care of nearly any set you may buy in future.

The new Balkite Charger with both high and low charging rates is easily the greatest charger value in radio. It combines the advantages of both trickle and rapid charging. At the low rate, on trickle charge, it automatically keeps your "A" battery fully charged, and in effect converts it into a light socket "A" power supply. Its high rate provides an ample reserve of power for the largest sets.

Add these Balkite Units to your radio set. Then you will enjoy the last word in radio convenience, and silent, unfailing power from the light socket. Ask your dealer. Fansteel Products Co., Inc., North Chicago, Illinois.

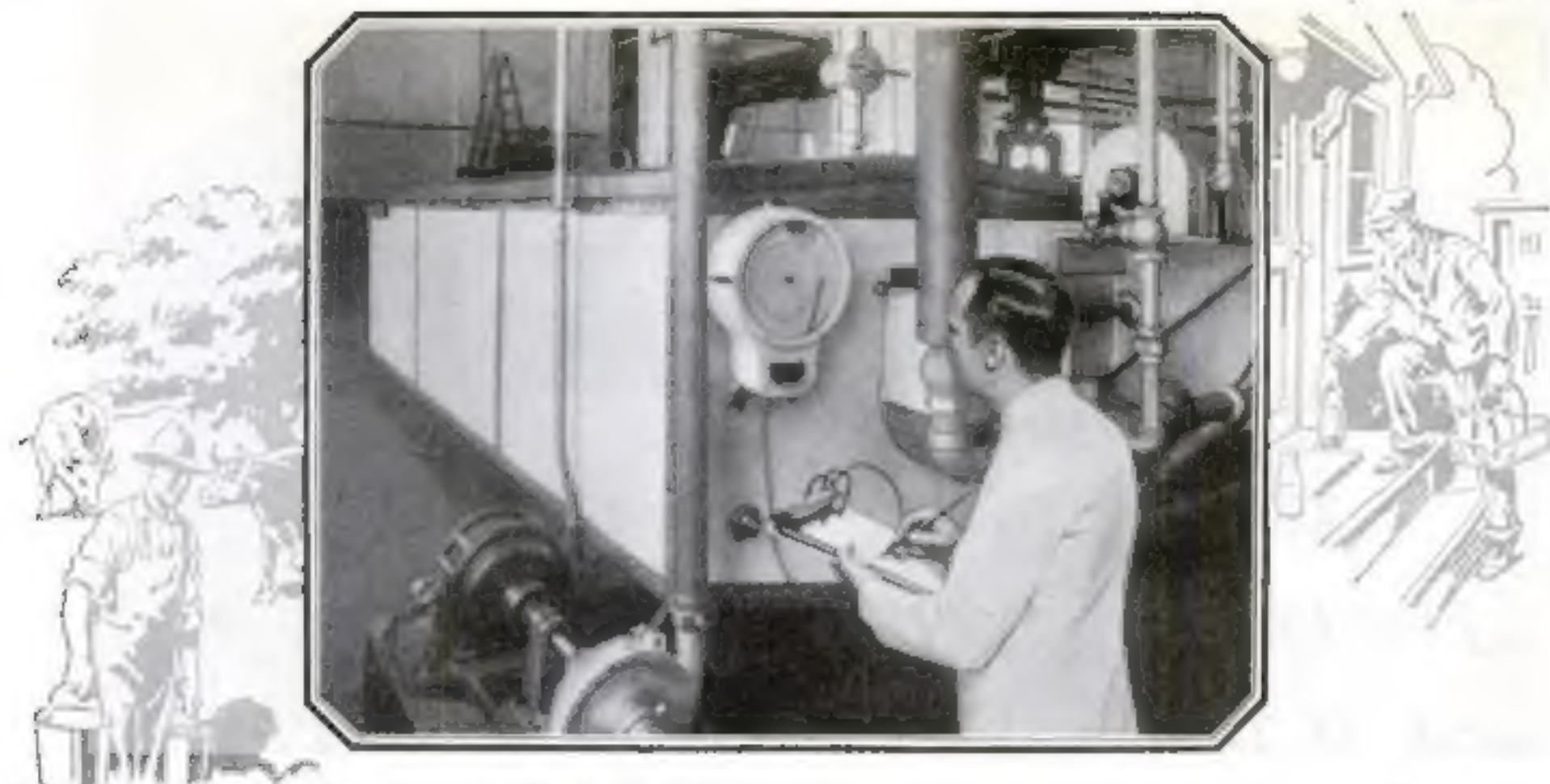
Balkite "B"-W \$27.50; "B"-X \$42; "B"-Y \$69; Balkite Charger \$19.50; West of Rockies \$20; (In Canada "B"-W \$39; "B"-X \$59.50; "B"-Y \$96; Charger \$27.50.)

FANSTEEL
Balkite
Radio Power Units

THE BALKITE LINE OF ELECTROLYTIC DEVICES IS PROTECTED BY



EDGAR W. ENGLE & SONS, GENERAL PATENT NO. 19,436, DATED OCT. 12, 1925



The health of Millions is protected by *Tycos* - the Sixth Sense

TO KILL any communicable disease germs which may be in the raw milk as it comes from the farm, milk is pasteurized. *Tycos* Instruments are an important factor in pasteurization—and pasteurization protects the health of millions.

The largest creamery in Detroit uses 30 *Tycos* Temperature Recorders and 15 *Tycos* Temperature Regulators to insure the proper pasteurization of their milk. One of the largest dairies in Cleveland says they are saving \$4,800 a year through the installation of *Tycos* Recording and Regulating Instruments. In this plant *Tycos* Instruments are paying for themselves every two months. And in addition they are making big savings in preventing spoilage.

Tycos Instruments for indicating, recording and controlling temperature are the Sixth Sense of Industry. They are saving labor costs, eliminating loss through spoilage and insuring uniformity of production in all branches of industry where the indicating, recording or controlling of heat is required.

Whether you make steel or bread, furniture, ice cream, tools, candy, or any other product that goes through manufacturing processes that require the indicating, recording or controlling of temperature, there is a type and style of instrument in the *Tycos* line of 8000 varieties that will help you. Informative literature on any type of instrument will be sent you promptly on request. Or our engineer will consult with you on the application of *Tycos* to your particular manufacturing problem.

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Tycos for the Home

Tycos Office Thermometers

An aid in promoting human efficiency.

Tycos Bath Thermometers

To enable you to get the most good from your bath.

Tycos Home Set

Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Wall Thermometers

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Tycos Quality Compasses

To show you the right way in unfamiliar country.

Tycos Fever Thermometers

A necessity in every home.

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Forecasts the weather twenty-four hours ahead with dependable accuracy.

Tycos Hygrometer

To enable you to keep the humidity of the atmosphere in your home correct at all times.

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Tycos Sphygmomanometer, Pocket and Office types.

Tycos Urinalysis Glassware.

Tycos Fever Thermometers.

Your dealer will show them to you. Ask us, or a postal, for booklets on any of the above.

Write for **Tycos** Bulletin



THE ~ SIXTH ~ SENSE ~ OF ~ INDUSTRY
***Tycos* Temperature Instruments**
INDICATING • RECORDING • CONTROLLING

This One



LF01-SRG-BLD1

Do you dream of *Independence* for them?

HOW much more rich will life be if you realize that each day is leading you towards a certain financial independence amid ideal working and living conditions? How much better for them!

Talk over with your wife the new plan which the financially powerful Brotherhood of Locomotive Engineers has worked out at Venice, Florida, to supply a basis of future independence for people who will operate business farms on soil of high fertility, backed by the experience and advice of the Venice Farm Board.

The Brotherhood, with sixty-three years of experience devoted to the improvement of living and working conditions, has made arrangements so that earnest people of moderate means can purchase Venice Farms on liberal terms—fronting on good roads cleared and ready to plant, with main drainage available.

Here the Farm Board operates Demonstration Farms, the Venice Nursery, and the Venice Dairy Farms, the facilities of which are available to Venice Business Farmers.

People are coming here who never dreamed of farming before. It is business farming—entirely different from the old-fashioned drudgery so long associated with farm life. Here nature lends a helping hand, crops grow bountifully and fast, and bring highest prices in early winter markets.

Here is year around out-door life under an ever-shining, life-giving sun. Every farm is in easy driving distance of the new model city of Venice. In this community an ideal life and real independence is possible. There is the confidence given by the Brotherhood's financial strength, practical help by men who know Florida farming, the companionship of people who have already embraced the opportunity and are on the ground, and finally nature's own best co-operation.

Venice a natural all-year resort

Venice life is divided between agriculture, industry and resort activities. Vacationists remark the variety of diversions. Here one finds the West Coast's only mainland beach and its most famous fishing grounds. Here is a modern city planned and built by experts which fronts on the beach. Adjacent to it is what visitors call the largest and most comprehensive farm development ever projected in America. . . . Venice hotels serve fruit, vegetables, milk and cream received fresh every day from Venice Farms near-by. Conveniently located are well-kept golf courses, tennis courts, quolls and other games, and excellent hunting and fishing are found in the tropical Myakka River and its valley. Hotel rates from \$3.00 to \$15.00, with 50% of rooms at \$5.00.

THE VENICE COMPANY
Owned by The Brotherhood of
Locomotive Engineers

We limit this advertising to demonstrable facts supplied by the Venice Farm Board and officials in charge of the City of Venice

*Come to
National Tarpon
Tournament
at Venice
June 4th to 25th*

Venice Florida

THEN LIVE THIS NEW LIFE



Mail this coupon for the Illustrated Booklet containing information and photographs supplied by the Venice Farm Board, and Resort Officials, describing the opportunity to lead a new free life under ideal conditions at Venice on the Gulf.

THE VENICE COMPANY

123 Venice Boulevard, Venice, Florida

Please send me the booklet, containing information and photographs supplied by the Venice Farm Board and Resort Officials, describing "A New Life of Independence" possible under the planter conditions at Venice.

Name

Address

Present Occupation

A BUDGET PLAN

That Will Help You Get Ahead

By WALLACE AMES, Financial Editor

"DON'T talk to me about budgets," expostulated Ted Carter. "We've tried them all, and all we have to show is a lot of loose leaf books, special forms and cash accounts which never would balance. Why, we set out the first of this year dead-set on making a budget work and already it is way out of joint."

The bond salesman was undiscouraged. He had been up against just this situation before. "I know the answer to your problem," he said, "and right now I am more interested in helping you to work out a successful budgeting plan than I am in selling you a bond. If you adopt the plan I want to show you, you will be able to buy bonds regularly."

"All right, let's have it," consented Carter, still unconvinced.

"To begin with," continued the bond man, "the trouble with all the budget plans you have tried is that they involve too much pesky detail. They do not take into consideration that you and your wife are two individuals, with ordinary human weaknesses, not a strict business concern with its systems and rigid rules. You get tired of keeping a cash account of pennies spent for newspapers; you lose interest when something unexpected comes up and, 'throws your budget out of joint.'"

"Probably you have tried a number of set budget forms, standardized systems which you got in some store. These 'ready-made' systems allow a certain percentage of your income for this, a certain percentage for that, but their allowances don't fit your case. You have been trying to squeeze your personal financial budget into a 'ready-made' plan and it doesn't work any more than a square peg fits in a round hole."

"IN THE first place, I want to show you how to design a budget plan *to order*, adjust and suit it to your circumstances."

"In the second place, I think I can show you how to operate a budget with a lot less bookkeeping than you have been bothered with in the past. Of course you will have to keep some accounts, but the amount of them can

be greatly reduced and simplified so that they will not be tiresome. And the result—your gain in satisfaction as well as in cash conserved—will be a rich reward."

"What is a budget, anyway?" asked the bond man, and then proceeded to answer the question himself. "It is a division or apportionment of your income so that you are spending the proper amount on various things. It is the one way to keep you out of financial holes. It is the only way you can be sure of having money for the things you need—when you need them."

"LET US begin, then, in your 'made-to-order' budget, by separating into two classes your *Fixed Charges* and your *Fluctuating Charges*. Your fixed charges consist of definite or easily controlled items such as rent, taxes, insurance premiums, savings, etc. Fluctuating charges consist of items which are subject to wide variations, such as clothes, provisions, entertaining, medical aid, etc."

"After your fixed charges are determined and provided for, you can practically forget them and concentrate on controlling the fluctuating charges, where the leaks are most likely to occur. This plan will also reduce the amount of account keeping you will have to do."

Then the bond salesman took out a paper on which he had written a general analysis of fixed and fluctuating charges. He gave this to Mr. Carter to use as a guide only. It was up to Carter to figure out what his own fixed and fluctuating charges were and what amount of his total income to reserve for each one. The general analysis on the memorandum paper was as follows:

FIXED CHARGES

- A. *Accumulation*: Savings; investment; building and loan shares; payments on mortgage; life insurance.
- B. *House*: Rent; interest on mortgage; property taxes; fire insurance.
- C. *Operation*: Food; gas; electricity; coal; telephone; servants; laundry; clothes repair.
- D. *Automobile*: Garage rent; insurance; payments on note; licenses.
- E. *Special*: Allowances to dependences; personal taxes; dues; charity; education; vacation.

FLUCTUATING CHARGES

- A. *Food*: Provisions; meals eaten out.
- B. *Auto Maintenance*: Gasoline and oil; repairs and adjustments; accessories.
- C. *Discretion*: Recreation; entertaining; exercise; books and magazines; hobbies, such as camera or radio or workshop.
- D. *Contingencies*: Household supplies; new furniture; house and household repairs; doctor, dentist and nurse; drugs, etc.
- E. *Personal*: Clothes; gifts; tobacco; candy; cash for miscellaneous items such as carfare.
- F. *Special*: To provide against necessary expenditures in excess of the regular budget allowance a small amount should be reserved to add as necessary to any of the established charges.

"Now," resumed the bond man, after they had looked over the memorandum, "let me make a few suggestions as to how to put your 'made-to-order' budget into operation."

"Tackle the fixed charges first. Make a memorandum on one page of the amount you need to put in the bank every week or month so that you will have enough money to meet these fixed charges when the bills come in. You can then determine how much of every pay check you will have to deposit to take care of fixed charges. There is no further account keeping on these. Your check book stubs are all you need."

"TOTAL up the amount of all fixed charges and subtract it from your gross income. The remainder you have to divide over fluctuating charges. Make a memorandum of these on another page."

"The only cash account you or your wife will have to keep is one of money spent on the fluctuating charges. And you both will have to train yourselves to keep your fluctuating expenses within the amount allotted."

"Get an ordinary memorandum book. Start a page for your current expenditures of each item in your fluctuating charges. Keep track of money spent and see that you do not go over your allotment."

Most of us find that operating a budget is such a nuisance that good resolutions to do it are often broken. Yet, living on a budget basis is extremely important in the business of getting ahead, and the Simplified Budget Plan outlined in this article will help you.



FIDELITY MEANS KEEPING FAITH

Judgment

When you till the soil you put your trust in nature. But you use judgment, also, in the planting.

In much the same way, investing calls for confidence in others. But judgment should guide you to the proper institution—one of proved experience, integrity and conservatism.

As you consider Fidelity Guaranteed First Mortgage Bonds, at $6\frac{1}{2}\%$, we urge you to confirm their safety by investigating the company that sponsors them. Our booklet, "The House Behind the Bonds," will aid you. Send for it, without obligation.

FIDELITY
BOND & MORTGAGE CO.

600 Chemical Bldg., St. Louis
1188 New York Life Bldg., Chicago
178 Colorado Nat'l Bank Bldg., Denver

FIDELITY GUARANTEES EVERY BOND

A Service for Readers

THIS Financial Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it so that it will be safe and so that it will grow.

The Editor of this Department is an authority on investment matters and he will not only every month give the readers interesting and useful information in his articles, but is also ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Address all your inquiries to Wallace Ames, Financial Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.

Any advertising appearing in this section will be carefully investigated by the Publisher of POPULAR SCIENCE MONTHLY. Readers can be sure that companies advertising are reliable and that they offer securities which represent sound financial investments. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

Booklets that Will Help You Get Ahead

ANYONE with money available for investments will find the booklets listed below of help in getting ahead financially. You may obtain any of these booklets by writing direct to the issuing house. It will be appreciated if you mention POPULAR SCIENCE MONTHLY when writing for booklets.

How to Build an Independent Income (1927 Edition)—Describes a plan for buying $6\frac{1}{2}\%$ First Mortgage Bonds by payments of \$10 or more a month, and shows the results that may be accomplished by systematic investment at $6\frac{1}{2}\%$. For copies address: The F. H. Smith Company, Smith Building, Washington, D. C. Ask for Booklet 75.

Why Your Real Estate Bonds Should Be Guaranteed is the self-explanatory title of a booklet on a subject of wide interest among investors in Real Estate bonds. Address: Adair Realty & Trust Co., Healey Building, Atlanta, Ga. Ask for Booklet P. S.-2.

Forty-four Years Without Loss to Any Investor presents the safety record of this house and describes the safeguards constituting the Straus Plan. Address: S. W. Straus & Co., Desk P, Fifth Avenue & 46th Street, New York, N. Y.

The Strength of the Utilities, with illustrations, charts and layman's language, presents facts that every investor should know regarding the public utility industry. Address: Halsey, Stuart & Co., 201 So. La Salle St., Chicago, Ill. Ask for Booklet P. S.-S. U.

The Making of a Good Investment explains the methods employed by the United States Mortgage Bond Co. in originating first mortgage bond issues which pay $6\frac{1}{2}\%$ with principal and interest guaranteed, or $6\frac{1}{2}\%$ without the guarantee, which is optional with the investor. Address: United States Mortgage Bond Company, 365 U. S. Mortgage Bldg., Detroit, Mich.

An Investment Insured for Its Lifetime describes a plan of insured mortgage investments. Nine points of safety are explained. Address: Mortgage Security Company of America, Norfolk, Va.

Rules for Safe Investments explains in language that the layman can understand the important factors of safety of real estate bonds. Address: American Bond & Mortgage Company, 145 Madison Avenue, New York, N. Y., and ask for Booklet P. S.-40.

Buying Bonds by Mail explains how the investor may safely and conveniently deal with an investment banker through the mails, and without the usual advantage of direct contact. Address: A. C. Allyn & Co., 67 West Monroe Street, Chicago, Ill. Ask for Booklet D. E.-2450.

Your Money covers the points of general interest to the investor who is planning to put his money in sound mortgage bond investments. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Bldg., Chicago, Ill.

Investment Service explains the service given by a first mortgage bond house. Address: Federal Bond & Mortgage Co., 1444 Griswold Street, Detroit, Mich.

The Science of Fortune Building, published by George M. Forman & Co., is the explanation of practical, tested plans employed by investors to attain financial independence. Address: George M. Forman & Co., 164 West Monroe St., Chicago, Ill. Ask for Booklet 833.

Investors' Guide, published by Greenbaum Sons Investment Company, combines a description of "bank safeguarded" bonds with an outline of the service of that company. Address: Greenbaum Sons Investment Co., 9 So. LaSalle St., Chicago, Ill.

You, too, can build an INDEPENDENT INCOME

with **$6\frac{1}{2}\%$ SMITH BONDS**

TODAY, when means are provided for thrifty men and women to invest their savings in sound securities, the way to financial success is open, and the rules are simple and few:

- 1 Set aside a part of each month's income as capital;
- 2 Invest that capital in good bonds to produce more income;
- 3 Insist upon safety.

The longer you follow this method, the faster your money grows; for, obviously, the more income you receive the more bonds you can buy, and the more bonds you buy the more income you receive. As to the third rule, by insisting upon safety you make sure that you will hold all of your gains.

SMITH BONDS combine the interest rate of $6\frac{1}{2}\%$ with the security of first mortgages on modern, income-producing city property, and with safeguards that have resulted in our record of

No Loss to Any Investor in 54 Years

As a result of this record, confidence in SMITH BONDS is world-wide. Men and women in 48 States and in 51 countries and territories abroad have bought SMITH BONDS by mail.

You may buy SMITH BONDS in \$1,000, \$500 and \$100 denominations, outright for cash, or under an Investment Savings Plan that pays the full rate of bond interest— $6\frac{1}{2}\%$ —on regular monthly payments of \$10, \$20, \$30, \$40, \$50 or more.

Mail the form below for our booklets, "Fifty-Four Years of Proven Safety" and "How to Build an Independent Income."

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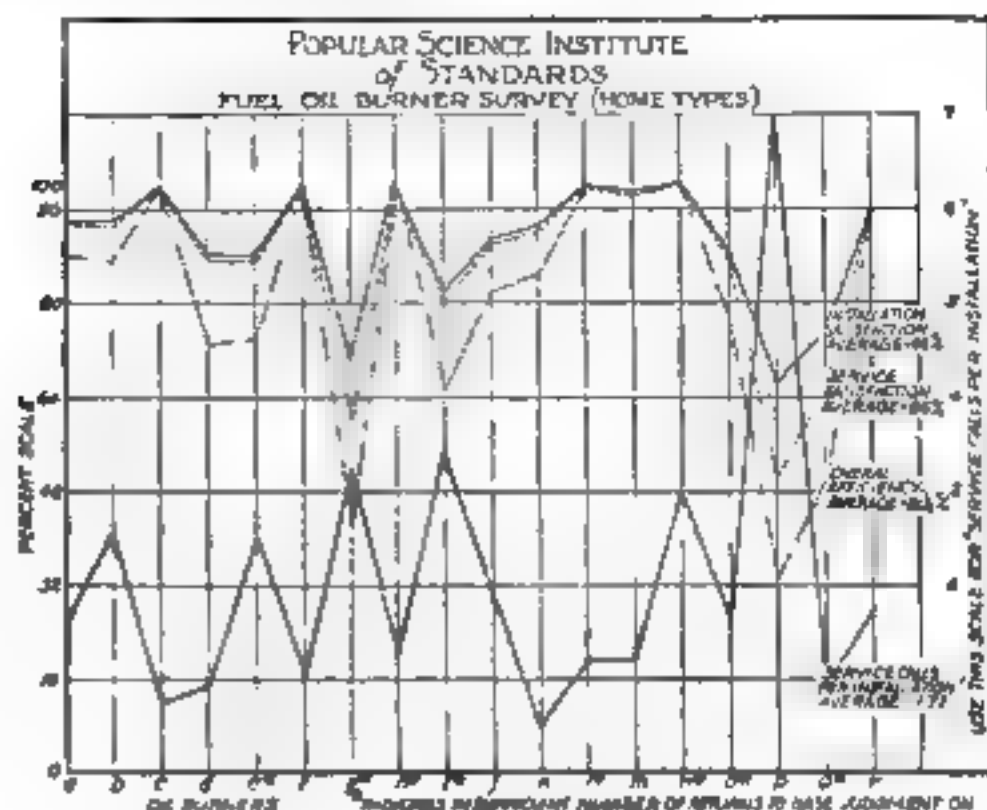
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Name..... 75-1

Address.....

This graph shows the very definite type of information the Popular Science Institute has on oil burners as a result of its investigations among 3,000 oil burner owners.



Do You Know

How to Pick a Good Oil Burner?

A MAN who recently had an oil burner installed in his home was telling how he went about selecting it. I marveled at the haphazard, even careless, way he had made his choice and yet I knew him to be a shrewd and careful buyer of other things that cost a fraction of the price of an oil burner.

In buying an overcoat, a piece of jewelry, or even a pipe, I know perfectly well that this acquaintance of mine would never have been willing to make his selection on the basis of what information he had gathered from a friend or two, or some salesman. He would have judged for himself, or else made inquiries of someone better informed and entirely impartial.

But in buying an oil burner, he had been up against a different proposition. Here he was investing several hundred dollars and yet had no gage of past experience or source of expert advice to aid him in his purchase. So this major investment was made on a guess, a lucky one, fortunately. He selected (or, rather, blindfoldedly drew) a burner which our Popular Science Institute of Standards has found to be one of the very best, after thoroughly investigating some three thousand installations of oil burners.

Guesswork, as most people realize, is not a safe way to go about selecting anything. Now that the Popular Science Institute has extended its activities to include the investigation of oil burners, you can buy these marvelous new labor savers without resorting to guesswork. Already, twelve hundred readers of POPULAR SCIENCE MONTHLY have come to us for advice in installing oil burners in their homes.

By PROF. COLLINS P. BLISS, *Director*
Popular Science Institute of Standards

They have reasoned that it is considerably safer to go by the experience of three thousand people than that of the few oil burner users among their acquaintance.

In investigating these three thousand installations, the Popular Science Institute of Standards has not confined its search to any one city or section of the country. A comprehensive and fair picture of just what degree of satisfaction oil burners are giving, and which of those on the market are good, was gained by covering installations in small towns and cities scattered all over the country from Maine to California.

We asked these oil burner owners how long they had had their burner installed, how many service calls had been required, what kind of service

they received, whether their burner was costing them more or less than using coal as a fuel, how much more they would be willing to pay for oil before they would go back to burning coal, whether there was a disturbing noise from the burner and, finally, were they satisfied with the burner as a whole. When we got through asking all three thousand owners these questions, we were able to judge just which burners could be purchased with the positive assurance they would give satisfaction.

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2. Type of heating system used.
3. Average coal consumption per year.
4. Whether there is gas or electricity in house.

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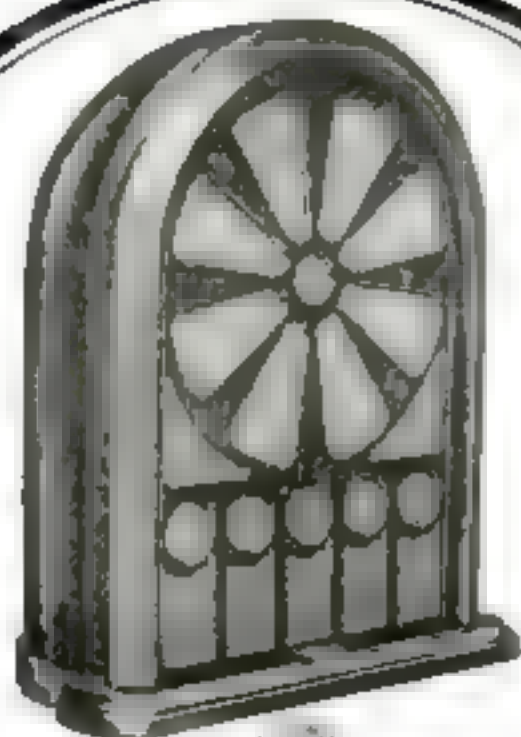
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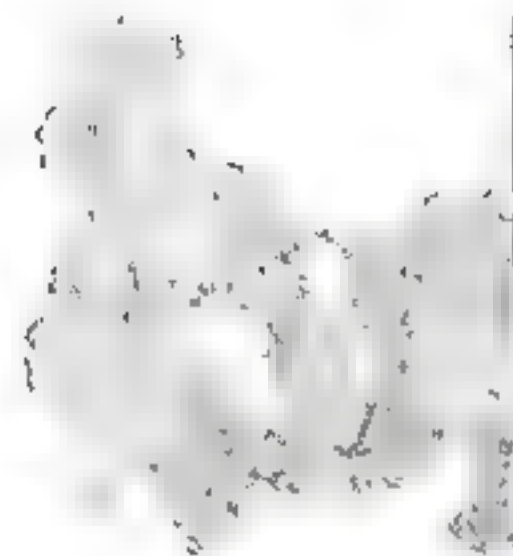




A Job for One in a Million!

Why Only a Few Men Can Photograph Cities, Chart Forests, Explore Jungles from Aircraft

By H. A. BRUNO



SIX thousand feet above the town of Cornung, Iowa, two veteran air-men swept across the blue sky in an old war-time De Havilland plane, making a photographic air map of the countryside below. At the controls sat Harlan Guernsey, ex-war pilot, intent on battling a stubborn wind that tried to thrust his machine from the course charted on a survey map before him. In the rear cockpit A. O. Russell, photographer, bent over the adjustments of a large camera, whose searching eye protruded downward through a hole in the fuselage.

The camera was clicking off its exposures with monotonous regularity when suddenly, with a deafening blast, the big 400-horsepower motor backfired, igniting the gas-filled carburetor. Instantly the plane, and the men who rode it, were enveloped in flames.

Guernsey turned for one grim glance at his companion; then, with the instinct born of experience over the battle lines, he threw the plane into a sideslip. It was the one desperate chance, he knew, to blow the flame to the side and away from their faces.

Downward they plunged, a ghastly



U. S. Navy Photo

A camera eagle! Lieut. W. L. Richardson, chief photographer of the Bureau of Aeronautics, U. S. Navy descending into the "power can" of the durable *Los Angeles* from which he has taken many remarkable photographs, including those of the solar eclipse of January 1925. He took the eclipse pictures at an altitude of 8,000 feet, daintily perched with his camera on top of the swaying dirigible!

torch from the heavens. Russell braced himself for the crash. Just when death loomed as inevitable, Guernsey, in a last frantic effort, with his face already blistered by the terrific heat, flattened the plane out of its sideslip in time to make a landing in a clear field. The fiery thing hounced wildly along the ground, and as it came to a stop the pilot dove headlong through the flames and over the side. Scrambling to his feet, he looked for his comrade. What he saw was Russell struggling over the edge of the cockpit, his precious camera clutched tightly

in his arms! A few moments later the machine was a smoldering skeleton.

But the next day they were back on the same job in another plane. That is the way of the aerial photographer and the photographic pilot, able partners in a remarkable new profession which is blazing trails, for the progress of industry and discovery. This thrilling episode of last Armistice Day simply typifies the unbeatable spirit, grit and skill of men who today are following the adventurous footsteps of pioneer surveyors of the past who plunged with rod and transit into unknown spaces, charted wildernesses,

and wrote new frontiers on the maps.

TEN years ago the science of aerial photography was virtually unknown beyond the battle lines of the war, where it played a vital rôle. Yet even then there were young Americans who, looking into the future, saw a great opportunity for peace-time use of pictures from the sky. They visioned themselves soaring high among the clouds and, with eagle eye, surveying the face of the earth far below; mapping its mountains and streams, its crowded centers of industry.



The last air photo of the ill-fated Shenandoah plowing through the clouds, as a birdman saw her. Above: Capt. A. W. Stevens, noted sky photographer, charting Brazilian jungle with his "serial eye."

Today scores of these eagle men are flying over the countryside with their remarkable cameras; some of them so high that while they can peer down through lenses and make visible, permanent records of your house and lot, office or factory, they are completely lost to your sight from below! Braving all weather, risking the bumping of winged ships in tricky air currents, trusting their lives to the smooth running of machinery, often facing the peril of a forced landing in the wilds, they are performing a service of ever-increasing value.

BY MAPPING entire cities from the air, they have revealed at a glance solutions to difficult problems of traffic and city planning. In the rôle of timber cruisers, they have surveyed and mapped thousands of square miles of forest lands, not only charting the locations of varieties of timber, but making possible an actual count of the standing trees.

They have aided in planning great industrial plants; laid down the right-of-ways for power lines, charted fire hazards, solved the tangle of railway terminals, charted golf courses, promoted real estate development. And finally, they have

penetrated remote and unexplored regions, bringing to light vast resources of unused power and wealth. All these things have been made possible by the invention of marvelous automatic cameras, under the long-range scrutiny of which no detail can escape.

One of the most remarkable and valuable of all the achievements of this new engineering science was the mapping of Greater New York from the sky—a task that required some 3,000 miles of flight and embraced a territory of 625 square miles. In all, 2,000 separate exposures were required to include the city's five boroughs. But when matched together to form a map, true to scale, the photographs portrayed in minute detail every building, thoroughfare, nook and corner of the great metropolis; even hurrying crowds and traffic congestion were plainly visible.

But of all the exploits of flying surveyors, few have surpassed the more recent adventures of the little group of Navy pilots and camera men who, under the command of Lieut. Ben H. Wyatt, U. S. N., flew last summer over un-

explored regions, bringing to light vast resources of unused power and wealth. All these things have been made possible by the invention of marvelous automatic cameras, under the long-range scrutiny of which no detail can escape.

ern, establishing supply bases first at Ketchikan, then at Juneau, Wrangell and Petersburg, ventured in two camera planes out over unpenetrated forests and rugged mountain ranges, leaving behind them one emergency plane to take up the search should one of them fail to return on schedule. Climbing to a height of more than two miles above sea level, they skimmed over snow-capped peaks, or looked down from giddy heights into deep wooded valleys. And always as they flew they were face to face with peril. Anywhere in that wild, uninhabited land engine failure and a forced landing meant disaster.

And yet they carried on the survey with incredible speed. Equipped with ingenious three-lens cameras capable of making three exposures simultaneously, and flying at a speed of a hundred miles an hour, they were able in one hour to map a strip seven miles wide and one hundred miles long, or 700 square miles. On the average they surveyed a thousand square miles a day. In 385 flying hours they traveled more than 85,000 miles!

THEY discovered, incidentally, hundreds of new lakes and rivers, many of them potential sources of immense power to turn the wheels of industry in the Far North. They found millions of acres of priceless timber. And they explored treacherous rivers that have run rich with gold, and ancient glaciers reaching icy caps thousands of feet to the sky.

When at last they returned from their hazardous venture, with every plane intact, they brought back not only a remarkable pictorial record of discovery, but proof of the practicality of aircraft for the most difficult kind of surveying and exploration.



Side partners from the beginning—camera man and pilot, braving the hazards of the air with 1914 style plane.

explored and forbidding fastnesses of Alaska, completing in three months a survey of Uncle Sam's last frontier that otherwise might have required ten years of struggle through all but impassable wilderness. This achievement followed closely upon that of Capt. George H. Wilkins, the Polar explorer, to whom belongs the credit of taking the first aerial photographs far up in the Arctic Circle.

To the blinking eye of the camera, automatically recording all it saw, Alaska's rich storehouses gave up new secrets. The Navy fi-



Mapping New York from the sky—pieced together, the 2,000 exposures made portrayed every building in the metropolis.

Aerial photography is no one-man game. It is an extremely exacting business which calls for perfect teamwork between pilot and camera man. They share adventures and dangers together. They must combine courage and resourcefulness with quick wit and scientific accuracy.

If you could travel with them on one of their mapping trips, you would realize quickly why these qualities are needed. The pilot must guide his plane back and forth, along imaginary parallel lines or "strips," until the entire area to be surveyed has been photographed. As he flies, a long roll of photographic film passes automatically through the camera and is exposed automatically at regulated intervals, producing a succession of photographs. The procedure, in effect, is the reverse of that for a motion picture: the camera moves, while the objects are stationary.

SINCE all the photographs obviously must be to the same scale, the first job of the pilot is to keep his ship always at the same altitude—no mean task when you consider that the air is full of invisible bumps and pockets. Moreover, to keep to his imaginary line, he must make allowances for side drift in a cross wind, sometimes he must "crab" along his imaginary guide line with the plane pointing in an entirely different direction. Add to that the job of constantly checking his instrument dials and gauges, guarding against rocking and pitching, maintaining a constant speed, and at the same time craning his neck over the cockpit to get his bearings, and you'll see that almost any other kind of driving is child's play in comparison. As one photo pilot expressed it:

"If you really want to know what it's like, try walking

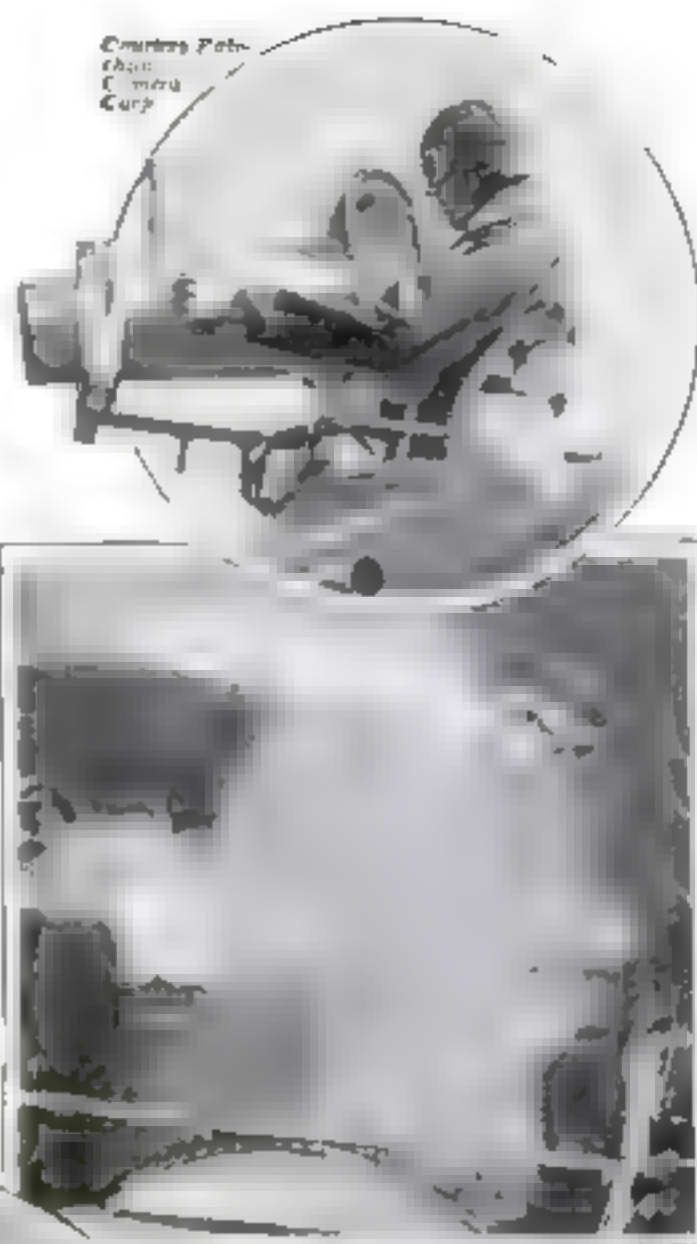
sideways on stilts along a crack in the floor while viewing the crack through the small lenses of binoculars."

Small wonder experts say that only four or five out of every hundred trained airmen can become photographic pilots.

AND the camera man is much the same sort of busy, cool-headed individual. His chief concern is to time the consecutive exposures of the film in accordance with the speed of the plane, and in such a way that they shall overlap each other like shingles, so that not a single spot in the area under survey will be missing when the photographs are fitted together in the mosaic map. Also, he must continually adjust his camera to make up for any deviation of the plane from its course.

In the routine of their work the aerial map makers have come upon more than one astonishing discovery. A short time ago, for example, photographers flying on a survey over Connecticut succeeded in lowering the tax rate in five towns by discovering and locating "lost property" which

Courtesy Potomac Camera Corp.



Remarkable photograph of Niagara Falls, showing the American and Canadian falls and Suspension Bridge, taken by Major Hamilton Maxwell. Upper photo: Shooting at long range with one of the marvelous new aerial cameras.



Small boat in a remote mountain lake of Quebec, surprised by a daring sky photographer.

had escaped the tax assessor's list. When the photographs were developed, they disclosed hundreds of houses, barns and other buildings on which no taxes had been levied. In one town, the aerial survey revealed 1896 buildings, including 248 stores on the main street, which had gone tax free, with the result that the camera men were instrumental not only in cutting the taxes of individual residents, but in adding millions of dollars to the public treasury.

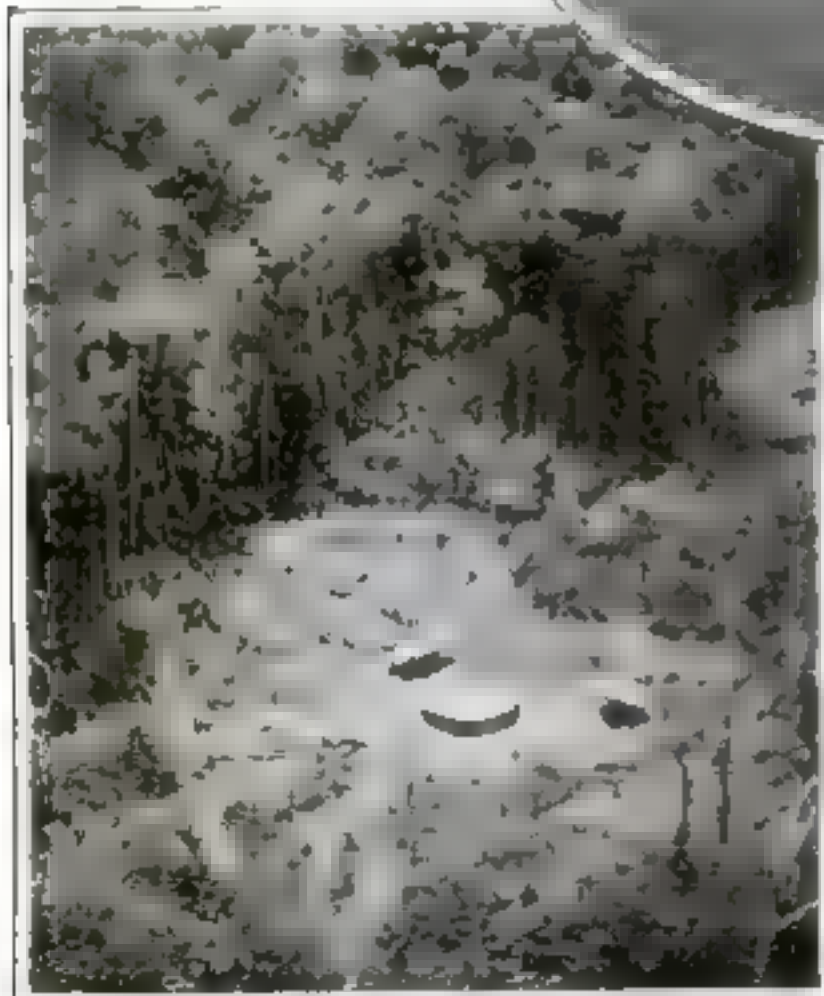
Another strange discovery made some time ago during an aerial survey remains an unsolved mystery. On a map-making trip north of New York

City, photographers had occasion to fly above the Hudson river. Later when the photographs were developed, one of these disclosed two submarines lying beneath the waters of the river.

Quick communication with naval authorities established the fact that none of Uncle Sam's submarines was operating in that vicinity. And, since it was peace time, there was no cause to suspect an enemy invasion. Naval officers who studied the photographs, however, were positive that the forms which the photographs revealed were undersea craft. How they got there or what their mission might be, no one could guess. The only possible answer seemed to be that the submarines were rum-runners' craft. Government rum chasers sped up the Hudson to investigate, but when they reached the spot indicated on the photograph, the undersea forms had vanished without a trace.

NEARLY every sky photographer could tell you of hair-raising experiences through which he has passed. R. A. Smith, a veteran at the game, has had more than his share of narrow escapes. Two years ago, for instance, while mapping a drainage district in Florida, he and his pilot, E. P. Lott, were forced down by a

(Continued on page 104)



Indian encampment in Brazilian jungle, never before seen by white man and discovered by the all-seeing camera's eye.

TISHY

Because they tagged him with that name, he made a tragic blunder—How he redeemed himself nobly in the hiss of icy seas

By *CAPTAIN DINGLE*

Illustrated by Anton Otto Fischer



Tishy knew where to go. Brug in the lee of the engine room casing he found two deck chairs side by side. The girl sat up straight, and her face lighted



THERE seemed no good reason for giving Burton such a nickname. As he stood up there on the navigating bridge of the *Diadem* in the swirling snow, handling the great steamer with the art of genius, he looked very much of a man, in spite of his apparent lack of inches. All the passengers, and as many of the crew as could, watched in fascination the maneuvers of a lifeboat, battling with the long green seas in the bitter cold, midway between the *Diadem* and a partially demasted windjammer from whose signal halyards flags snapped in the wind. The steamer was closing on the ship, to give the boat a short pull and make a lee for it.

The captain stood in the bridge wing, anxiously estimating distances, but he made no comment. He seemed confident in the chief officer's handling of his steamer. That was not misplaced confidence. Nobody called the chief officer "Tishy" on duty. Only in the less official atmosphere of the off-duty hours did the other officers use that name. And Debron was responsible for it in the first place. Debron, who at that moment handled the lifeboat out there in the roaring cold seas with much the same sort of inspired skill as that with which the big steamer was handled.

Debron had been mate of the sailing ship in which he and Burton learned their profession together. Burton had been second mate. Both completed their apprenticeship and got their tickets at the same time, but Burton hadn't the same commanding physique as Debron; the bulkier man got the preference in that first test of fitness, and perhaps it was right that it should be so, for there were many occasions under the square rig when brawn and muscle counted for much in a pinch. There the two had remained pals. Debron always conceded superior brilliance to Burton. That was just. Burton secured his extra-master's certificate at the same time that Debron got his plain master's. But while together in the windjammer, Debron lorded it in physical superiority, always protective; always jumping in to take the heavy work when any other second mate would have fought for it as a right.

There it was that "Tishy" was born. Decent, honest, stolid Debron thought he did a wonderful bit of creative work in nick-

naming his chum "Tishy." And Burton endured it, rather than fight a gleeful third mate and a half-dozen of ribald 'prentices, some of whom were, at sixteen, bigger men than he was at twenty-two. But here, in the *Diadem*, it was different. He was entitled to some dignity. Debron was only second mate now; Burton's higher grade certificate had given him the seat, but Debron had introduced Tishy to the mess, and of course the name stuck. That sort of name will. Therefore, standing by the engine-room telegraph, when all his mind should be centered upon his handling of the big steamer, Burton found bitterness flooding his soul because Debron, the author of so many little unintentional injuries, had usurped the place in that boat which rightfully belonged to him.

LET Debron take the boat. He's a buskier man than you." That's what the captain had said. He had softened it a bit by making some remark about Burton's ability to handle the steamer, but it had not fooled Burton. He watched the sailing ship and the boat as if he wished the one would run over the other, and with luck sink both.

What had seemed likely to be a thrilling boat rescue, and a nice bit of salvage to follow, developed into a simple towing job. It was annoying. That big steamer cost money to run, days of delay meant black looks from owners. Yet a man could not leave that old windjammer skipper and his people in the lurch. Rather, his stubbornness in sticking by his ship merited praise. And so the *Diadem's* master agreed. The passengers cheered when Debron took a line across, by which a towline was hauled aboard; they cheered Debron himself when he came over the side from the boat. And when the steamer straightened out on her course, dragging the helpless sailing ship astern of her, they praised the captain for the splendid manner in which he had handled the job.

Tishy ate bitter bread on the bridge until his watch was up, and then he went to his room by devious ways of ladder and alleyway in order to avoid meeting people. Never before had he realized the full depth of the rut he had fallen into. In the matter of his profession he was bound to go ahead. He was a keen,



Debron headed the boat straight for the windjammer, a stripped and dismantled wall of the sea. The old shipper gesticulated and howled at him.

clever officer, a born steamship man, a navigational wizard. He absorbed the modern gadgets of navigation, Gyro compass, electric sounding machine, radio bearings, and the rest, far more easily than poor Debron had absorbed the simpler rules of the sheer essentials. And both his captain and his owners knew his worth. But when he recalled the faces among the passengers, to avoid which he sneaked below, he gave way to a little exhibition of rage which might have amazed steady-going Debron had he been privileged to see it.

Of all the passengers he knew, scarcely one regarded him as anything more than a pleasant, courteous officer who shone when a dance was afoot, who always looked dapper and smart, who, no doubt, was placed there just for the purpose of being looked, and doing just that. Debron might often be found in the center of a crowd of men, telling men's yarns, laughing very manfully. Debron might be found before dinner drinking a man-size cocktail with the smoking room habitués. Tishy—he even thought of himself by that hated name in his wrath. Tishy was always sought after at tea time, by the ladies. In the evening, he might be asked into the music salon to sing. Not one, man or woman, of all those people, but doubtless looked upon Debron as a pillar of strength set there for their safe seafaring, and looked upon Tishy as a pretty little fellow kindly put aboard by thoughtful owners to amuse their idle hours.

TISHY flung his cap into the bunk, and grabbed a cigarette so savagely that it broke into three bits. He hurled the bits at the cap, and swore. That is, he began to swear, caught sight of a book half hidden beneath the cap, and caught himself up sharply with bitten lips. He had been wrong in his estimate of the passengers. There was one who looked up to him; who asked him questions about the sea, and ships, and the stars, who sat as if entranced while he spoke; who—

He grabbed the book, and swung on his cap, darting back on deck by the saloon companionway as if bound upon some very

congenial errand indeed. The decks were deserted. Evening was at hand; the cold was piercing, snow still dusted the air, almost blotting out the wallowing old windjammer at the end of the long towline. There were voices in the smoking room. The social hall was aglitter with lights, at odds with tea equipage. Tishy knew where to go. Slung in the lee of the engine-room casing he found two deck chairs side by side. In one, swathed like a mummy in heavy rugs, a hawk-nosed old gentleman lay, with closed eyes, only his beak of a nose and eyelids showing through his wrappings. A teacup and saucer clattered to pieces on the deck beside the chair, and the occupant of the second chair began to unwind as Tishy appeared.

"Father! Why didn't you give it to me?" queried a girl's voice, with a trace of weary patience almost overstrained. Then "Oh! You startled me, Mr. Burton—in a much happier tone."

THE girl sat up straight, and her face lighted. It was easy to see that here was one person at least who thought pretty highly of Ned Burton. Blanche Torrey was small, and of the type that keeps its youth, when she smiled, she smiled from her curly black hair right down to her dainty toes, and whatever or whoever was near was the better and brighter for her smile. Perhaps that was why her ailing, bad-tempered father clung to her like an old man of the sea, rarely permitting her time to relax or take part in the amusements of the crowd.

"That's the fourth cup and saucer father's broken. He will not let me put it down, ever. Do you think they'll send us a ball?" she smiled. When she looked up into Burton's face like that, he forgot that he ever felt bitterness. He warmed through and through—and not the least of his warmth was directed at old Colonel Torrey for his selfish monopoly of his daughter's time and care. That was not a kindly warmth, though.

"I don't think you'll be punished very severely," he said. "They may possibly insist on serving the colonel's tea in a

tin mug. I came up to give you this," handing her the book. "This writer catches the real spirit of the sea as no other that I have read does. You'll find beauty in the one called 'Sea of Light.'"

THE colonel roused himself, and querulously wanted to be taken below to prepare for dinner. His invalidity seemed to have little effect upon his appetite. Burton folded up the rug, and held the book while Blanche buttoned up the old man's coat, then opened the companionway door and watched the pair go below with mixed feelings warring within him. The steamer had only been six days at sea; he had never met Blanche Torrey before. He did not like old Torrey very much, but he did like Blanche. Liking was not the word. He was in love. And a glow warmed him to the toes when at length he closed the doors against the snowstorm, and turned to go back to his own quarters. Just then he cared but little, if at all, for the face the world showed him. Let men call him Tishy. What of it? Let Debron take the boat, get the credit. What of that? Debron never won a spile in his life like that which Blanche flashed back at Tishy Burton just before the door closed on the companionway.

Burton walked the length of the hurricane deck, past the smoking room. Voices, of course; warmth, light, and companionship of men. What did he care? Burton half stopped. A cocktail seemed entirely in tune with his spirit. Through the big round porthole he glimpsed the interior. There were all the habits. Big men of the world. Enjoying their voyage. Forgetting landwise cares. And in their midst was Debron. They were listening with jovial eyes and keen attention to some yarn he was spinning, and when it was finished the smoking room rang with their merriment. The last fleeting glance Tishy Burton shot through the port glass showed him Debron in a circle of hearty back-whackers, aglow and agleam with the natural gratification of a man, not yet old, who receives the adulation of his fellows.

"Darned hero worshippers!" growled Tishy, bending his head against the storm and hurling himself along the alleyway to the seclusion of his room.

AS THE steamer dragged its unwieldy tow into the waters near the coast, her navigators began to look for sun or star to verify her position. For days the snow had blinded the skies. The steamer was sheathed in ice from mizzenmast to the weather side to the bows on both sides. On the tow, only one man was ever visible. Aboard that straggled and dismantled wad of the seas, with her bare decks and lack of shelter, only a helmsman showed his nose outside. Seemingly with reason, too, for the wreckage was frozen into a solid lump of grotesque form: all of the old warship from broken jib boom to stump of foremast was solid ice. Her forecastle head, anchors, capstan, headstays and all had nothing of shipshape left. Roaring through the seas after the powerful steamer, the old ship took sprays in sheets, and already she was down by the head through sheer weight of ice.

As the ships came within the anticipated range of the lightship marking their turning point, the captain was often on deck with his sextant. The second officer scarcely bothered to put his sextant back in the case as long as there was a chance of a star appearing. And the officers keeping watches were on the alert through the night, anxious to get a sight, for the dead-reckoning of the past few days was none too certain, with that lumbering tow astern, dragging the steamer back, hauling her to one side or the other as she

sheered wildly to the weight of the ice fastened about her head.

Tishy suffered many moods in those anxious days. When he could talk to Blanche Torrey, he felt as if the world was not only splendid, but that it actually belonged to him. At other times he was not so sure that he cared who the world belonged to. Why the devil did Debron want to plaster such a name as "Tishy" on a man? That was what Burton wondered. And how grown men could derive pleasure, or simple fun, out of calling a man by such a name absolutely beat him. But he felt better about it, nevertheless. He hated Debron very heartily that evening when the lightship ought to have shown up. Burton was talking with Blanche, telling her about stars, and navigation, and some things not particularly concerned with either of those studies when Debron came looking for him.

"OH, TISHY, the Old Man wants a line of soundings," Debron said, then saw the girl, apologized with a grin, and added: "The electrical sounder is not working well, Mr. Burton. It gave a jump from three hundred to thirty just now."

Burton went about the job in staidly fashion, taking a quartermaster along to the sounding machine, and ran his line in proper style, but he settled inwardly because she had heard him called "Tishy" Debron again. Of course. Nobody but that big lout would think it funny.

During the night a star came out. Debron was on the bridge. Burton stayed up, too, for whatever he might feel personally toward Debron, he was instinctively eager to fix the steamer's position. Burton stood with his sextant just clear of the shelter of the bridge, patiently trying to hold a star in the field of his glass long enough to bring the image down to the hazy horizon. His line of soundings had puzzled him. There should have been more water. If he could catch a sight of that star—

"There's the light, Tishy!" Debron suddenly called softly from the bridge. "We're away up. It's almost dawn to port."

"Better call the captain if you feel uneasy," replied Tishy. He was not on watch anyhow, why should he concern himself with Debron's anxieties? He went ahead with his sextant, jerking the star down. He had not yet seen the light. Debron could see it up there on the higher bridge. As a matter of fact, Tishy was not at all sure that the lightship was in sight. So many young seamen, such for instance as Debron, who would never grow up except in powerful physique, often mistook a star low on a hazy horizon for an expected light. Judging by all the signs, soundings, and so forth, that lightship should not be in sight anywhere near the bearing Debron reported it on.

Debron on the bridge muttered to himself. He was a qualified officer, had a master's ticket and would be chagrined if, after calling the master, he were found to be unduly anxious. If that were actually the lightship, why, then there was no need for anxiety, since the ship had made her point as expected, and all that was necessary was to get a four-point bearing for distance, enter it in the log, change course, and go ahead full of confidence. Debron, an senior second mate, was navigator; if he couldn't do that, he would hear something hot from the Old Man later on.

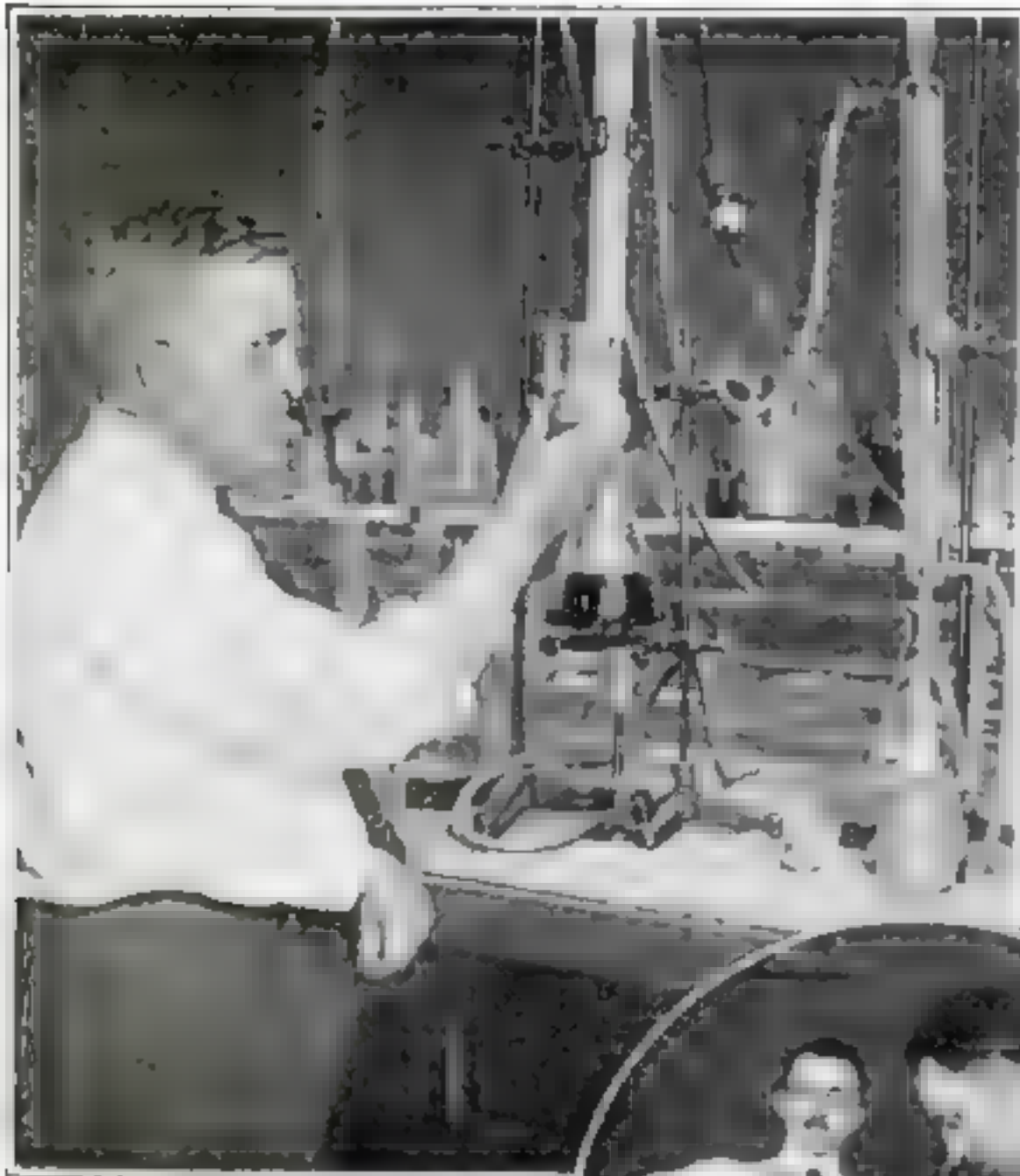
Tishy fiddled with his star. The horizon was uncertain. But there flashed across his glass the stab of the light, and he stopped fussing for a moment and got the light into an angle with the star. He held the contact for several minutes, and when he took the telescope from his eye, it was with a sharp gasp of wonder. Another sight, another contact, and a

(Continued on page 145)



Out there in the icy seas, swimming like an otter with a heaving line snaking out after him, Tishy begged the swirling water fiercely.

The Truth about Poison Liquor



Dr. W. V. Linder, chemistry chief U. S. Internal Revenue Bureau, is taking a very precise alcohol denaturation test which he says is effective and less harmful than wood alcohol.

OF LATE Uncle Sam has been on trial before the bar of public opinion, charged with no less a crime than willful and premeditated murder.

The Government of the United States and particularly the officials who enforce prohibition, stand accused of poisoning industrial alcohol and so injuring or killing those who unlawfully buy and drink the liquor concocted from it by law breakers.

These startling accusations followed on the heels of reports indicating an appalling increase in liquor deaths in the last year. Heightened by the recent Government order doubling the amount of the poison, the reports aroused a furor of protest and controversy throughout the nation.

Among the protestants were highly responsible citizens, including educators, judges, journalists, statesmen and clergymen. Typical among them was Dr. Nicholas Murray Butler, president of Columbia University. "Murder," he declared, "just plain, unadorned murder by our glorious paternal Government, is what I think of the deaths attributed to the consumption of liquor



Behind the scenes in the new chemical warfare R. H. Gammett and Chief Chemist R. A. Edson testing seized bootleg for wood alcohol in Government laboratories, New York. Most bootleg liquor today contains this poison.

manufactured from poison alcohol?"

So much has been said both for and against the new Government order that most of us have found it difficult to get through to the bare facts in the case. Just what is all the hue and cry about?

Briefly, the Federal Government, in order to supply industry freely with much-needed grain alcohol and at the same time make that alcohol unfit to drink, requires it to be denatured with wood alcohol, a violent poison. But since the alcohol so denatured can be obtained readily, large quantities of it pass into the hands of bootleggers. They, in turn,

How Uncle Sam Wages Bitter Chemical War to Put Industrial Alcohol Beyond the Bootleggers' Reach

By

FREDERIC DAMRAU, M. D.

attempt to "re-nature" it by re-distilling or "removing" it. But it is chemically impossible to remove from grain alcohol all of the wood alcohol used in the denaturing process.

The result is that much of the alcohol which goes to the public in bootleg gin, whiskey and other drinks, is certain to contain quantities of the poisonous denaturant. Government officials say that each year 10,000,000 gallons of industrial alcohol produced every year under Federal supervision, at least 10,000,000 gallons find their way into bootleg liquor. Thus, when other ingredients are added, will make about a quart of liquor for every man, woman and child in the country. In fact, most of the bootleg liquor sold today has its source in industrial alcohol denatured with poison.

OUT of this situation have arisen the bitter complaints that Uncle Sam is trying to poison those who will not obey the prohibition law. The accusers, on the one hand, charge that the Government, knowing full well that some of the poisoned liquor will be consumed unlawfully, stands responsible for deaths caused by drinking it. Some have gone so far as to accuse the authorities of seeking to terrify the public into abstinence.

On the other hand, defenders of the Government's course contend that the bootleggers, and not the Government, are the real murderers. They argue, too, that the victims of poisoned liquor are really suicides, that the Government cannot be expected to protect a citizen from his own folly, that, anyway, most deaths are due to excessive drinking rather than to the poison, and, finally, that most of the fuss about poisoned liquor is, after all, anti-prohibition propaganda.

There you have the two sides of the argument. Strangely enough, though,

neither has emphasized the unanswerable scientific fact about the whole business. It is this: The reason Uncle Sam requires the use of wood alcohol as a denaturant, is that chemistry thus far has been unable to discover a less harmful way of preventing the conversion of industrial alcohol into a beverage fit to drink.

Wood alcohol has proved to be the only known denaturant which bootleggers can't "cook" entirely away. This is because it boils at approximately the same temperature as the pure grain alcohol with which it is mixed. Bootleggers' chemists may be able to distill it off up to a certain point, but beyond that point the grain alcohol boils away with it.

THIS is about what happens: Grain (ethyl) alcohol boils at seventy-eight degrees centigrade; wood (methyl) alcohol at sixty-five degrees. When the bootlegger puts denatured alcohol into a still and raises the temperature to sixty-five degrees, the wood alcohol will begin to boil, evaporate and pass into the condenser, but not all of it will evaporate until a much higher temperature is reached. Even if he raises the temperature to the boiling point of grain alcohol, the evaporation of the wood alcohol will not be complete. Before seventy-eight degrees is reached, the grain alcohol will begin to evaporate along with the wood alcohol. The two never can be entirely separated. The double dose of wood alcohol added by Government regulation at the beginning of the year was intended to make industrial alcohol not twice as poisonous, but half as likely to be utilized

quantities and at a cost that made it commercially practicable.

Out of its use have grown some of our greatest industries, as, for example, the manufacture of explosives, artificial silks, products such as celluloid, perfumes, extracts, anti-freeze mixtures, and so on. Today it is indispensable to some 200 industries, and wonderful new uses for it are being found continually. It is vital to chemical progress.

As long as there was plenty of potable liquor to be obtained, no one ever thought of drinking denatured alcohol. But when prohibition came along, and later when smuggled liquor became harder and harder to obtain, bootleggers turned to the industrial product. And then the trouble began. There developed a keen chemical warfare between the chemists of the bootleggers on the one hand, and the Government chemists on the other. The former were bent on "cooking" out the denaturants; the latter were equally intent on preventing them from doing so.

NOW, many different ingredients have been employed in many different formulae—about sixty in all—for denaturing alcohol. The Government divides the product into two general classes: completely denatured alcohol and specially denatured alcohol. For the former, wood alcohol is used almost entirely. For the latter, the method is varied according to the special requirements of the industry in which the alcohol is to be used. For example, brucine, a poison closely related to strychnine, has been largely used as the denaturant for making "beauty" preparations and barbers' supplies. Nic-

otine has been put into the prohibited list, and various other poisons, drugs, dyes, and so on, are other denaturants.

The specially denatured

alcohols fell one by one before the ingenuity of the bootleggers' chemists. They found a way to remove brucine by repeatedly distilling the alcohol. They did the same thing with nicotine and other denaturants. So successful were they, in fact, that the Government at last was compelled to tighten the restrictions on the sale of specially denatured alcohol and since then it has been sold only by permit under heavy bonds.

This has left completely denatured alcohol the only alcohol easily available. There are no restrictions on its sale, for no amount of chemical skill can remove all the wood alcohol from it and make it fit to drink. It is sold everywhere, in any paint store or public garage, no questions asked.

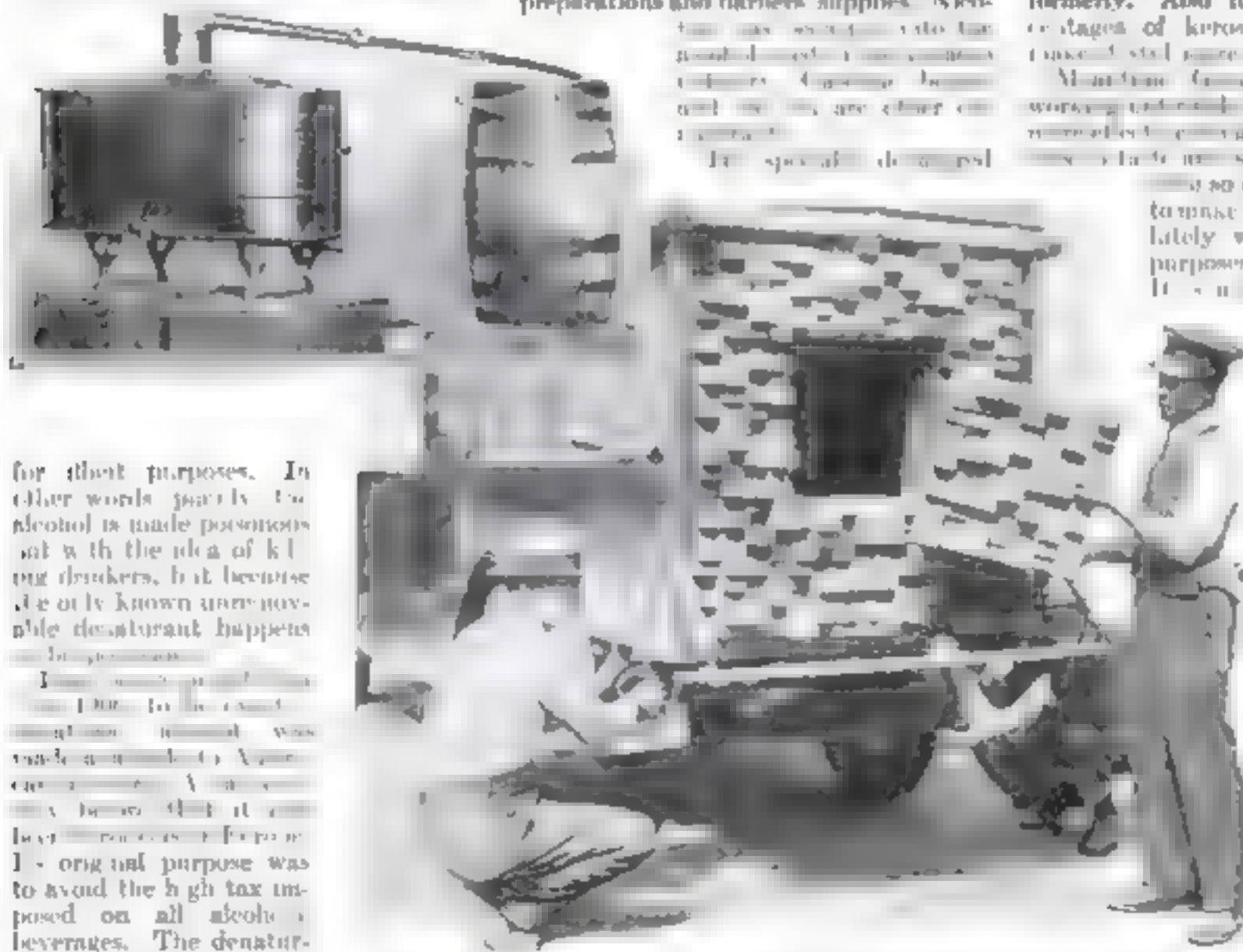
Wood alcohol may cause violent illness, blindness or death after the consumption of a surprisingly small amount. In most cases of wood alcohol poisoning, the mental processes are benumbed and clouded, there is marked loss of memory accompanied by extreme dizziness, which may be followed by death. Highly poisonous doses produce overwhelming prostration. The patient sinks rapidly into coma, and death may come within twenty-four hours, or may be delayed as long as a week.

WOOD alcohol, moreover, is intensely poisonous to the optic nerves. Permanent blindness may result from a single drink. Under the new governmental order, completely denatured alcohol will contain four percent of wood alcohol, instead of two percent as formerly. Also it contains small percentages of ketone and pyridine to make it still more unpalatable.

Meanwhile Government chemists are working untiringly to discover a new and more effective denaturant—one so obnoxious in taste and smell, and at the same

time so difficult to remove, as to make industrial alcohol absolutely worthless for beverage purposes and therefore safe. It is a difficult problem, one which has long baffled chemists.

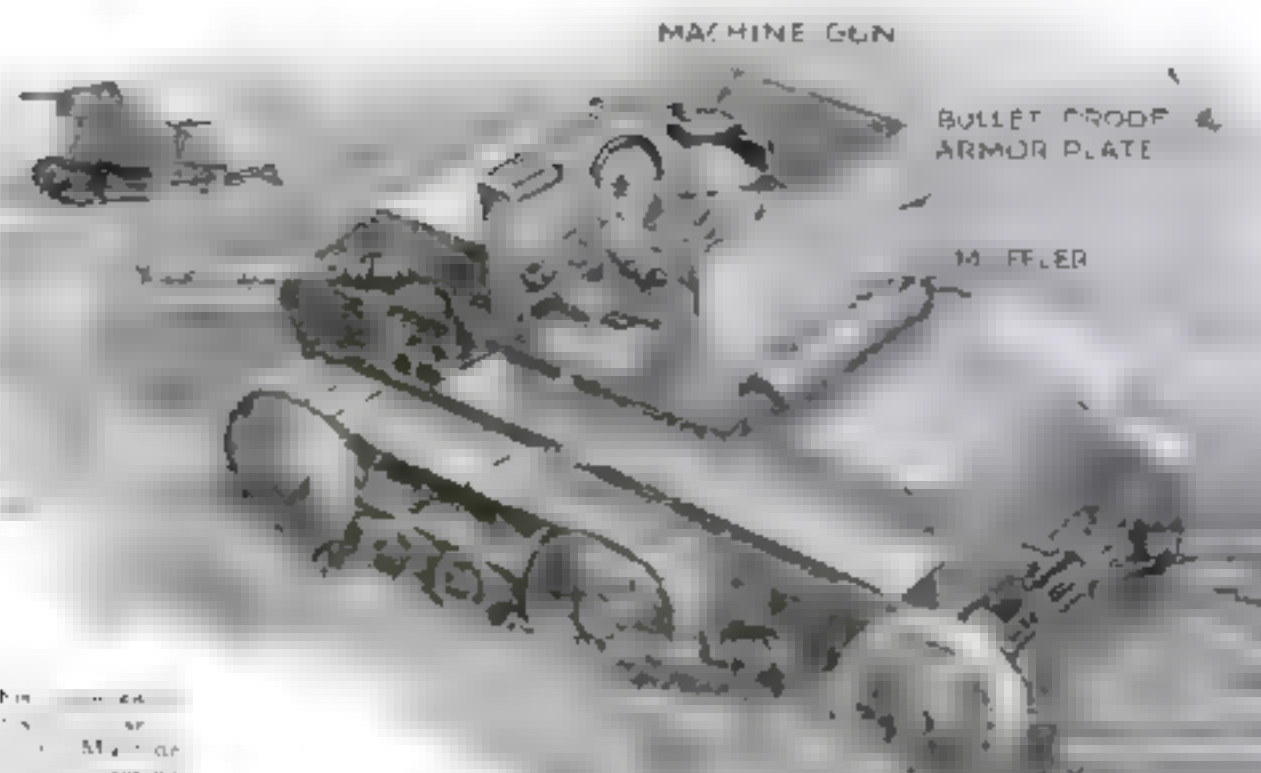
As this is written, however, reports from Washington indicate that a solution may be in sight. J. M. Doran, head chemist of the Prohibition Unit, recently announced the development of certain eye-smelling and bad-tasting oil compounds which combined with wood alcohol, would advertise themselves like a bad egg in an omelet, and banish forever any desire to consume the mixture. It is impossible by any known method, he says, to rid the alcohol of these oils,



What appeared to be an innocent truckload of lumber turned out to be a bootlegger's ingenious device to transport booze, when the odor of a broken bottle betrayed this vehicle to Los Angeles prohibition agents. Seventy cases of liquor were taken from the interior which is entered by a trapdoor of board ends. Above: Typical still—50-gallon capacity with which bootleggers' chemists try to "cook" the wood alcohol out of industrial alcohol. Federal prohibition officers capture as many as 170,000 of these in a single year.

for those purposes. In other words, partly, the alcohol is made poisonous not with the idea of keeping drinkers, but because the only known unremovable denaturant happens to be poisonous.

There is another point to be made. The reason Uncle Sam requires the use of wood alcohol as a denaturant, is that chemistry thus far has been unable to discover a less harmful way of preventing the conversion of industrial alcohol into a beverage fit to drink. The denaturing process placed tax-free in the hands of manufacturers and chemists one of the two most useful chemical solvents known—in



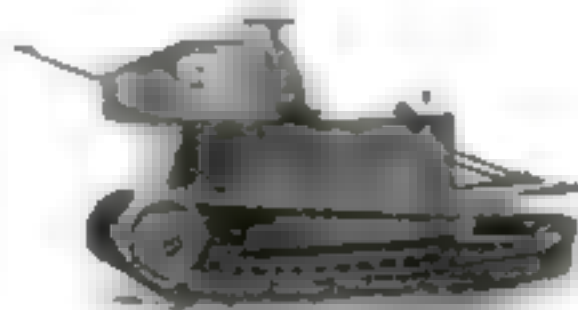
The driver of this monster one-man tank sits in a turret, gunning with a machine gun, while a pump-driven wheel air compressor forces air into the engine's cylinders.

Amazing New Engines of War

One-man tanks give artillery new mobility, while huge monsters haul guns, lead attack, or belch poison gas

ARMOR CLAD warriors dashing across a battlefield, spitting leaden death from protruding gun barrels—steel juggernauts that belch clouds of lethal fumes—will these land craft decide tomorrow's battles? Latest of peace-time inventions, the new tanks are ready to play their part should war again grip the world.

When premiers of the British dominions assembled recently at Cambridge, England, they viewed a startling display of the latest war machines in action. Fleet one-man tanks, motors roaring, caterpillars whirling, raced about like swarms of monster ants. Bulkier craft capered over the pulled field at twenty miles an hour, hauling huge guns. An experiment in the last war, the tank of



The gunner of a speedy "whippet" tank crouches behind a revolving turret.

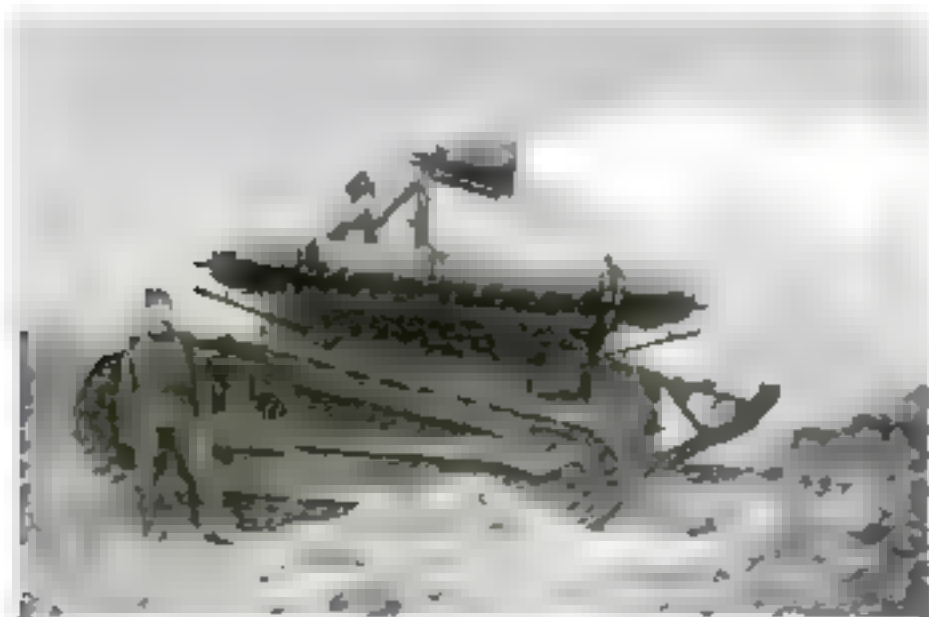
the future, illustrated by these machines, may strike terror in whole armies.

Headed the single machine gun of the one-man "whippet" tank pictured in the center of the page—one of the new British inventions, the gunner crouches as he charges against the enemy. A battalion

of these speedy machines might overwhelm an army on foot. Another novel one-man machine, sketched above, adds a pair of rubber-tired steering wheels at the rear. It, too, is a fast craft.

From Warsaw, Poland, comes news of a tank recently tried out that hurls poison gas from grisly steel cylinders slung on its roof. It is pictured at the left below. Funnel-shaped projectors release a flood of deadly fumes. Again, battleships on caterpillar treads, monster tanks with gun-spiked turrets, cruise overland against hostile armies.

Only a shell as direct as can harm these bullet-proof machines. It takes time to aim a big gun. The new tanks, by virtue of their speed, are somewhere else by the time enemy gunners have found the range.



Impervious to bullets, this latest Polish war machine belches poison gas in the enemy's midst. Its odd-shaped keel tramples obstructions.



Wheels speed this battle craft along transport roads. A lever lifts them up and drops the craft on its caterpillar tread for cross-country cruises.

Conquerors of the North

Stories of Wonderful Dogs with Hearts of Steel, and of Wild Races with Death across Arctic Snows



By
Jack O'Donnell

Leonhard Seppala, who Breeds and Races the Fastest Teams of the North, Tells of His Amazing Adventures

BOBBIY BROWN, beloved Alaskan miner, prospector and dog racer, was dying. A buzz saw had severed one leg above the ankle and had thrown him violently against a piece of shafting, breaking the other leg and causing internal injuries. There wasn't a doctor in Dine Creek, where the accident happened. The nearest surgeon was at Candle, fifty-eight miles away.

Between Dine Creek and Candle lay a desolate, wind-swept, snowbound stretch of wild Alaskan country. The thermometer registered thirty below. Night was falling.

Bobby Brown's friends were in despair. Tenderly but cruelly, they attempted to stop the ebb of his lifeblood and ease his pains. But only a surgeon could save or prolong his life.

Then came the electrifying news that Leonhard Seppala, king of the Arctic trails, was near by with his team of Siberian sled dogs—the same team that had wrested the dog-racing crown from the head of "Scotty" Allen—the fastest team in the North.

INSTANTLY,

hope for Bobby Brown flamed in the hearts of the men of Dine Creek. Seppala meant speed, medical assistance, perhaps life. If any body could run a victorious race with Death, Seppala was the man—Seppala and his great leader, Togo, and his other fleet-footed Siberian dogs.

Summoning Seppala, the miners tenderly lifted Brown to an improvised cot and placed him on the great musher's sled. Although he was in great pain, Brown looked up into Seppala's eyes and

smiled a brave gesture of confidence.

The next minute Seppala cried, "Mush!" Togo and his fellows sprang into action and, while the group of prospectors and miners of Dine Creek waved a silent God-speed, the sled moved off.

For seven and a half hours Seppala drove his dogs through a blinding, sting-

ing blizzard, neither man nor dog giving thought to hunger or thirst. Over fifty-eight miles of snow and ice covered trails, the dreaded spear ice cutting into their bellies, the twenty dogs mushed onward. When inky blackness settled over the trail, Seppala trusted his life, and that

of his passenger, to Togo, his leader. And Togo, aware of the trust, bent his head to the blizzard and inspired his fellows by his bravery, his stamina and his intelligence.

It was almost ten o'clock when Seppala sighted the lights of Candle. Half after the hour the errand of mercy ended—at the hospital. Bobby Brown, still conscious but weakened by loss of blood, suited his gratitude to Seppala—and Togo—as he was lifted and taken to the operating table. Seppala had won a temporary victory, at least, over death, for, despite the fact that Bobby Brown died two days later, the stricken man lived long enough to see members of his family.

That race against death in the face of fearful obstacles, is talked of whenever Alaskans get together. Seppala himself makes light of it, just as he does of his gigantic feat of covering 840 miles in the historic antitoxin race to Nome in the winter of 1925.

"IT WAS the only thing I could do for a good friend," he told me in New York recently. "If anyone deserves credit, it is Togo, my lead dog. After all, a musher is only as good as his dogs. If Togo or the other nineteen Siberians in that team had failed, I would have failed and Bobby Brown would have died on the trail."

"Up there"—

meaning in the Arctic regions—"that sort of errand is part of our everyday lives. We make no particular fuss about bravery. To us in Alaska the antitoxin drive, for instance, was nothing to get excited about. A number of persons in Nome were suffering from diphtheria.



Over the frozen wastes of the North race these teams of swift-footed huskies—bearing mails, passengers, messages of life and death. Capable of tremendous speed against fearful odds fearless as their timber wolf ancestors. Photo above: Seppala's lead dog, Togo. On the lead dog's courage, intelligence and power of leadership depends the behavior of the entire team.

ing blizzard, neither man nor dog giving thought to hunger or thirst. Over fifty-eight miles of snow and ice covered trails, the dreaded spear ice cutting into their bellies, the twenty dogs mushed onward. When inky blackness settled over the trail, Seppala trusted his life, and that

The doctors needed antitoxin. There wasn't any of the serum in town. There were 900,000 units of it at Nenana. What was there to do but go to Nenana and get it? Nothing! So it was done."

"So it was done."

The phrase aptly expresses the attitude of these men of the North toward their daily life, whether that life be devoted to mining, prospecting, carrying the mail over wind-swept trails, racing the dog teams, or establishing a town on a new gold field.

Invariably the dogs are important factors. When, in 1896, Alaska was the Mecca of thousands of gold-hungry adventurers, the civilized world discovered that in the North existed a breed of dogs of marvelous stamina, speed, and courage. These were the native Alaskan dogs called Malamutes or huskies, strong, redoubtable canines bred by wild dogs and timber wolves. Because railroads and other means of transporting men and supplies over the snow-covered wastes were unknown, these dogs were pressed into service. Throughout the length and breadth of that land rang the stentorian command "Mush!" a corruption of the French word *marchons*, the cry of the early French voyageurs to their dogs.

WHEN dog racing became the major sport in Alaska, mushers like Seppala, "Scotty" Allan, "Fox" Ramsay and "Iron Man" Johnson turned their attention to the improving of the breed of dogs.

Ramsay, an English remittance man, imported Siberian sled dogs and raced them with surprising success. Seppala followed suit and today the Siberian sled dog is considered the last thing in racing animals. He is especially desirable in long hauls, being tireless, courageous, and endowed with great strength.

Dog racing, however, is not the chief reason for improving the breed of sled dogs. Until Alaska is covered with a network of railroads, the dog musher and his dogs will be indispensable in transporting passengers, mail and supplies.

Being highly intelligent animals, the improved breed of sled dog is easily trained. Kindness, firmness, and appreciation are the three essentials. Once a master tells a dog to do a certain thing he must insist upon obedience until such time as the dog obeys.

In order to obviate impulsiveness and instill a spirit of stoicism into the beasts, the dogs are trained to await their meals with a minimum of barking, and to eat their daily ration without that avid voraciousness that characterizes most carnivorous animals.



"King of the Arctic Trails" Leonhard Seppala was known from end to end of Alaska long before he won world-wide fame as hero of the historic antitoxin race to Nome.

Seppala's own astounding control over his dogs was the subject of amazed comment following his recent spectacular victory in the second annual point-to-point race of the New England Dog Club. One racer even attributed it to a kind of hypnotism. "He doesn't drive his dogs—he just 'clucks' to them and they lay into their collars harder than I've ever seen dogs do it before. Something comes out of him and goes into those dogs with that clucking!"

Seppala says there are thrills aplenty in the musher's life, but they come unexpectedly and almost invariably in the absence of an audience.

There was, for instance, the day he became lost in a blizzard during the 1914

All-Alaska Sweepstakes, the dog-racing classic of the North.

Seppala ran into the blizzard about fifty miles from Nome on the way to Cande. He was on a new trail and the dog team, led by Suggen, sire of the now famous Togo, was making fair progress despite the high wind, snowdrifts and bitter cold. In a lull of the storm the great Norwegian musher realized he was lost.

"But I knew that if I headed due North I'd find a trail," he told me, "so I tried to steer in that direction. Suggen, however, kept trying to lead southwest. Somehow I did not trust the dog's instinct, and kept him to the northern course. Presently (Continued on page 134)



Winners all! Seppala and his Siberians, each a thoroughbred of the North. Their owner's most recent victory was the New England sled dog derby.



Members of the Aerial Experiment Association, 1908. left to right, "Ceszy" Baldwin Selfridge, who designed the first plane flown by the group, Glenn Curtiss Bell, inventor of the telephone, McCurdy, just getting around after a crash, and, as guest, Augustus Post

Glenn Curtiss—Air Pilot No. 1

Impressions and Reminiscences of Stirring Days of Experiment and Achievement That Changed the World

By FRANK PARKER STOCKBRIDGE

I DON'T remember when or how I first heard that a couple of young men named Wright had actually flown a heavier-than-air machine," said Glenn Curtiss in response to a question I put to him as we chatted one day in his Florida home. "Perhaps Captain Baldwin and I discussed it after the news of their experimental flights at Kitty Hawk had appeared in the newspapers; but if we did, it didn't make a lasting impression on me. We weren't thinking of heavier-than-air machines then; all of our interests were centered in the dirigible. It is quite likely that I was skeptical, like almost everybody else."

As a matter of fact, there was a general and quite fixed belief twenty years ago that man would never fly in a machine which did not have some sort of a balloon attached to it. That view was shared by the United States Patent Office, which did grant several patents on flying machines before the Wrights proved that the world was wrong in its opinion, but they had some kind of a lifting device. Mr. Curtiss remembers seeing the drawings of one of these inventions. It was provided with a harness to which were attached a dozen or more live eagles! That was a

sample of what most people thought of when they talked of flying machines.

If Glenn Curtiss had any other thoughts on the subject of airplanes they probably were to the effect, he says, that Professor Langley's unsuccessful attempt in 1903 to make his "aerodrome" fly was proof that nobody would ever fly in a machine which did not have inherent buoyancy. The failure of "Langley's folly," as the machine was called in the newspapers, had brought unlimited ridicule. It seemed, in the minds of most people, to settle the question of the airplane. The dirigible was the thing. And Captain Thomas S. Baldwin and Curtiss

had built and navigated and delivered to the United States War Department the very first dirigible ever bought by any government. That was in 1905, about the time that the first news of the Wrights' flights began to leak out, although they had actually got their machine into the air on December 17, 1903.

"I HAVE never been much of a prophet," smiled Mr. Curtiss. "I could not foresee, then, that within three years I myself would win the first American prize for flight in a heavier-than-air flying machine; that within ten years I would even fly the Langley machine."

I reminded Mr. Curtiss of one of his attempts at prophecy, made in the early days of aviation, to the effect that a speed of 150 miles an hour was about the limit of practical speed for an airplane.

"It does sound foolish now, doesn't it, with speed of above three hundred miles an hour already accomplished?" he responded. "Still, I erred on the conservative side. I based that statement on the belief which I held in common with others who were experimenting with flight, that the maximum speed of the plane could never be more than double

MR. STOCKBRIDGE writes here another brilliant chapter, the second of a series, in his absorbing story of a great pioneer of American aviation. The installment is complete in itself, so you'll enjoy it even if you begin the series with this issue.

the minimum speed. Now, the minimum speed at which the plane will stay right side up is the landing speed. I couldn't imagine anybody landing a plane at a higher speed than seventy-five miles an hour. I thought I was stretching it a little at that; so I guessed at the possible speed in flight at 150 miles. Now, however, planes are built with a landing speed of above three times their landing speed, and can land at ninety miles an hour, giving 800 miles and more as the high speed in flight. I am not prepared to set any limits to the possibilities of the future.

"NOT even this?" I suggested, picking up from among a pile of photographs on his desk a drawing depicting the trans-Atlantic passenger airplane of the future. It showed, not a flying boat but a flying ship—a regular three-decker triple-winged, glass-enclosed, with a luxurious saloon on the upper deck, obviously accommodations for scores of passengers.

"Not even that," he came back promptly. "Trans-Atlantic flight on regular schedules is bound to come. It might have come sooner but for the war. We were just getting ready for the first real attempt to fly across the ocean in 1914; then everything had to be subordinated to war needs—speed, maneuverability, altitude. The development of the airplane and the flying boat took a direction then from which it is only beginning to return. But it is as inevitable that trans-Atlantic flying service will be established as it was that trans-Atlantic telephony should be."

BACK in 1903, however, motorcycles with dirigibles "on the side" were still occupying Glenn Curtiss' attention. With Captain Baldwin he built dirigible after dirigible for exhibition purposes; personally he took his Curtiss motorcycles to all the important contests, and continued to win trophies and money prizes with unfading regularity.

Other people were thinking about heavier-than-air flying machines, though. One of them was Prof. Alexander Graham Bell, inventor of the telephone. Another was a man in Detroit who had an original idea for a flying machine.

Curtiss can't remember even the man's

name now, but he wanted a motor boat to fit a flying machine, of which he sent Curtiss a sketch. It was on the general lines of a length of pipe, being a cylinder with a wheel which he proposed to mount an engine and a propeller. He would get the expected double effect: the suction of air at one end of the cylinder would serve to lift the apparatus from the ground, while the force of the expelled air at the other end would push the machine through the air. Curtiss "didn't think much of the idea," but the man's credit was good, so he undertook to build the engine.

It was the largest engine he had ever designed—four cylinders and with gears ready to build it, he wondered what an engine like that would do



Alexander Graham Bell's original idea for a flying machine, developed into a dirigible. The engine was built by Curtiss, and the dirigible was built by Bell. It was the largest engine he had ever designed.

on a motorcycle. He had won prizes in all the motorcycle contests he had entered, but he wanted to go faster than anybody had ever traveled before or was likely to travel. So, while building the engine for the stovepipe flying machine, he built a big motorcycle to fit it. He knew he had something which would go fast if it could be ridden.

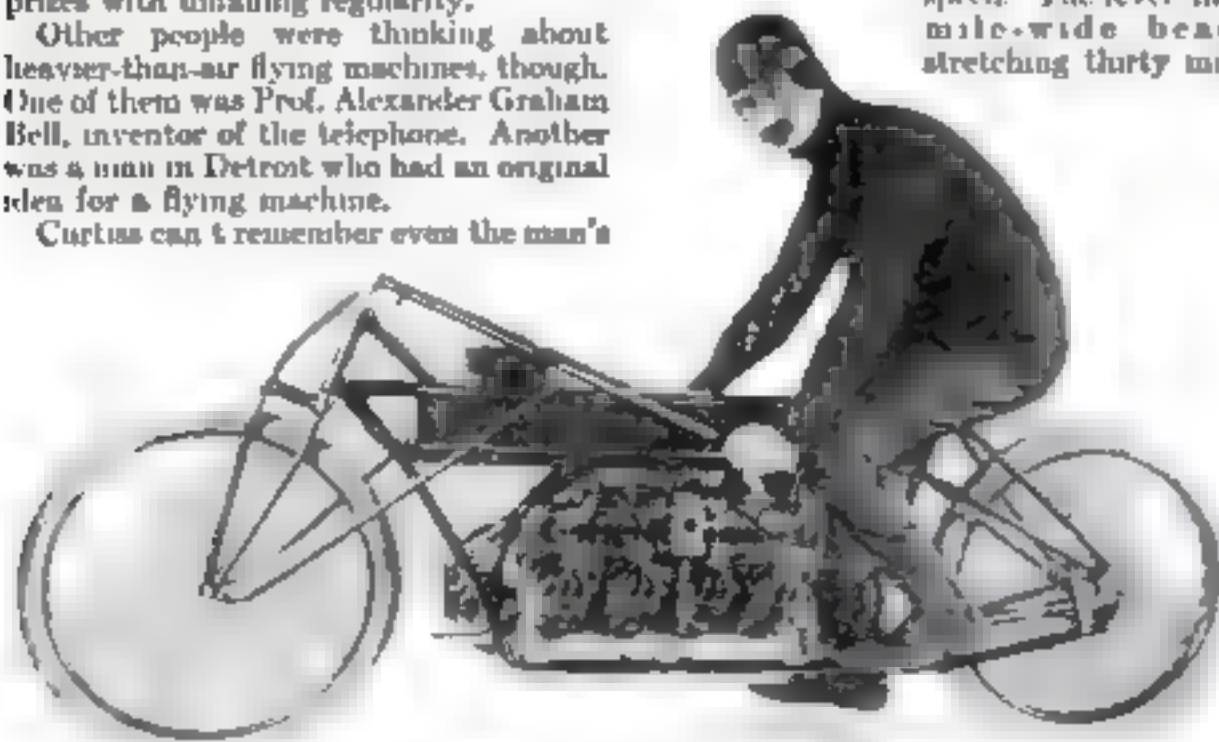
The big motorcycle was finished late in 1906. Curtiss put it aboard a train and started with it for Ormond Beach, Florida, then the proving ground where automobiles and motorcycles were tested for speed. The level half-mile-wide beach stretching thirty miles

straight away, with its water-parked sand, is still one of the world's greatest speed courses, though the Indianapolis Speedway has displaced it as the official testing ground. There was a meet scheduled for January, 1907, and this offered a chance to try the big machine.

"I was on my way to Ormond for that race when I first met Professor Bell," says Mr. Curtiss of this trip. "Interest in flying was growing, and the Aero Club of America had arranged the first Aeronautical Exhibition, in an armory in New York City. A good deal of interest had been aroused by the announcement that the Wright brothers would make an exhibit, and so they did, but their exhibit turned out to be the crank shaft from the engine of the plane in which they had made their first flights.

"PEOPLE who had expected them to show a complete airplane were disappointed, but they were right in not disclosing their invention. Their foreign patents were still pending. They might easily have forfeited their rights by showing at that time how their plane was controlled."

Professor Bell had ideas of his own about flying. He had watched Professor Langley's experiments closely from their beginning, and had been especially interested in the engine, designed by Charles M. Manly, with which the Langley machine had been equipped. That had been the lightest-weight gasoline engine ever built up to that time, weighing less than two pounds to the horsepower. But the Curtiss engine designed



The giant eight-cylinder motorcycle, driven by Curtiss himself, which, at Ormond Beach, Florida, in 1907, made a record for two-wheelers that still stands—a mile in 25 seconds.

for use on dirigibles were more powerful, just about as light in proportion to their power; and, at the Aeronautical Exhibition, Glenn Curtiss found Professor Bell absorbed in the study of them.

"That was how Professor Bell and I met," Mr. Curtiss said, "and I found him an enthusiast on the subject of flight. We talked about the reported success of the Wrights, and about the gliders with which Octave Chanute had made numerous experiments with air currents in the sand dunes of Lake Michigan's southeastern coast. Professor Bell thought that Chanute, the Wrights and all the rest were wrong in trying to fly flat planes. Safety in flight, he assured me, was to be found in the development of the tetrahedral kite."

"The word 'tetrahedral' rather flustered me, I guess. I'm sure I didn't know then that a tetrahedron is a form bounded by four triangular surfaces—in other words, a three-cornered pyramid, and Professor Bell had to explain it to me. He had been experimenting with kites made up of a great number of tetrahedral cells, two of the four sides of the tetrahedron being formed of silk like a pair of wings. The kites had flown with great success, at his summer home at Baddeck, Nova Scotia. He had even sent a man aloft on the kite string, and had made aerial photographs, the precursors of the airplane photographs so familiar to-day, with a camera attached to the tetrahedral kite.

"If he could build up a block of these tetrahedral cells in the right shape and size, and attach to the whole an engine of the right type and weight, he believed a machine would result which would rise by its own power, carrying a man. He thought the Curtiss engine was the thing he wanted."

AFTER talking with Curtiss awhile, Professor Bell concluded that the young engine expert might be useful in helping develop his idea. The upshot was that he invited Glenn Curtiss to visit him during the following summer at his country place at Baddeck, to talk about flying, and Curtiss promptly accepted.

From that momentous meeting, at which Glenn Curtiss' thoughts were turned definitely toward artificial flight as distinguished from ballooning, the young man went to Florida and at Ormond Beach, on January 24, 1907, drove his eight-cylindered motorcycle faster



One of the gliders Curtiss built at Hammondsport, N. Y., early in 1908, for preliminary experiments in flight from the hillsides of Lake Keuka. Neither he nor the other members of the Aerial Experiment Association had ever been in a plane, and this was to give them the "feel" of being in the air.

than any two-wheeled vehicle was ever driven before or since; faster, in fact, than anybody had ever traveled up to that time anywhere in the world!

A mile in twenty-six and two-fifths seconds was the amazing record which Glenn Curtiss set on that day. It is a record which still stands for motorcycles, although the giant machine, conforming

Company—followed the memorable summer of 1907, at Baddeck, with the three ardent young men who, with Curtiss and Professor Bell, formed the Aerial Experiment Association, out of which were to grow such epoch-making developments in the art of flying.

The others were two young Canadian engineers, P. W. Baldwin and J. A. D. McCurdy, and Lieutenant Thomas Selfridge of the United States Army. Baldwin had been assisting Professor Bell in the construction of his tetrahedral kites. He was not related to Captain Thomas Baldwin, associated with Curtiss in the development of the dirigible.

TO DISTINGUISH

the two Baldwins, the nickname of "Casey," derived from the baseball poem, "Casey at the Bat," was attached to the younger, and he is still referred to by his former associates in

pioneer aviation as "Casey" Baldwin.

McCurdy was the son of Professor Bell's photographer, who had done such excellent work in making aerial photographs from kites and was the inventor of the daylight developing outfit for roll film. Lieutenant Selfridge, a recent graduate of West Point and a young man of remarkable promise, had been detailed by the War Department to work with Professor Bell in the development of the flying machine. The word "aeroplane" was none too well established, and its Anglicized form of "airplane" had not come into use then. Professor Langley had called his machine an "aerodrome," and that was the term Professor Bell used for his tetrahedral device.

Nobody could foresee then that young Selfridge was to be the first man to lose his life in an airplane accident, killed in the crash of Orville Wright's machine on its first public flight. (Continued on page 113)

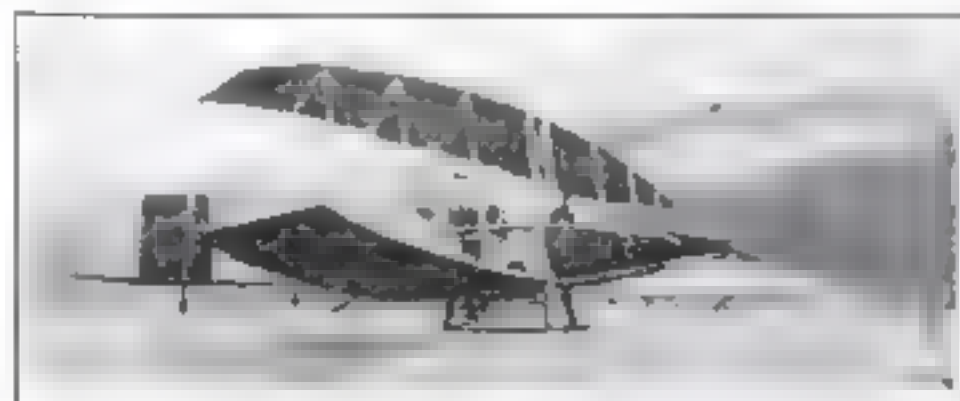


The White Wing, first airplane ever flown by Glenn Curtiss, on the day of its remarkable flight in May 1908, when it rose in the air to real flying height, covered a distance of 1,017 feet, and landed undamaged in a plowed field. Its wings were cotton coated with varnish.

to no accepted standard of design, was entered in a class by itself and the record is therefore not an "official" one under any of the rules governing motorcycle contests. This record stood for every class of land vehicle until 1920, when it was beaten by Tommy Milton in a racing automobile. But no two-wheeler has ever beaten the Curtiss record.

"How did it feel to go faster than you had ever gone before?" I asked him.

"I remember it satisfied my speed-craving," smiled Curtiss, "but I can't tell



Not so lucky as the White Wing, the Red Wing, above, first plane to be built by the Aerial Experiment Association, crashed on its trial flight.

Electric Hands *Prevent* Wrecks

New Railway Safety Devices Work

When Engineer Fails

By

L. U. REAVIS



LAATEST triumph of mechanical skill in the fight against railroad accidents, a new automatic signal system, just perfected, guards the safety of passengers on trial sections of two great railroads. On this page is explained pictorially the operation of the amazing devices.

Within the engineer's cab a panel with five lights reproduces in miniature the four possible settings of the wayside block signals. The engineer can see them at a glance even if the block signals themselves are obscured by rain or fog. So long as he observes them, and acknowledges each new one with a lever at his side, he may run his train without interference. If he fails to observe the proper speed limit, however, or by failure to press the acknowledging lever shows he

has not observed a signal, safety devices stop his train.

In the drawing, several "blocks" of track are foreshortened to show the entire system. Electric currents from the semaphore signals along the track course through the rails and operate the lights in the engineer's cab, by means of an ingenious "code" system. Each semaphore carries an electric interrupter that breaks up or "codes" the current at a frequency that corresponds to the position of the signal. Thus each indication of the semaphore broadcasts a certain "code message" along the rails. For instance, 180 interruptions a second is a code message meaning "Clear." Other signals have certain lower frequencies. "Danger" cuts off all current.

ON THE locomotive, delicate apparatus picks up and interprets the coded current. Energized from the track, electric coils actuate a set of relays that flash the proper light on the engineer's panel. As a check, a similar panel faces the fireman. Each signal change is accompanied by a whistle's blast to command the engineer's attention.

With this system, if a train ahead of the train is broken, the electric current is dead and a danger signal flashes up on the panel. Moreover, local trackmen, seeing an obstruction, can set a signal to de-energize a section of track thus stopping a train without recourse to the time-honored danger signal, the red flag.

LOCOMOTIVE EQUIPMENT

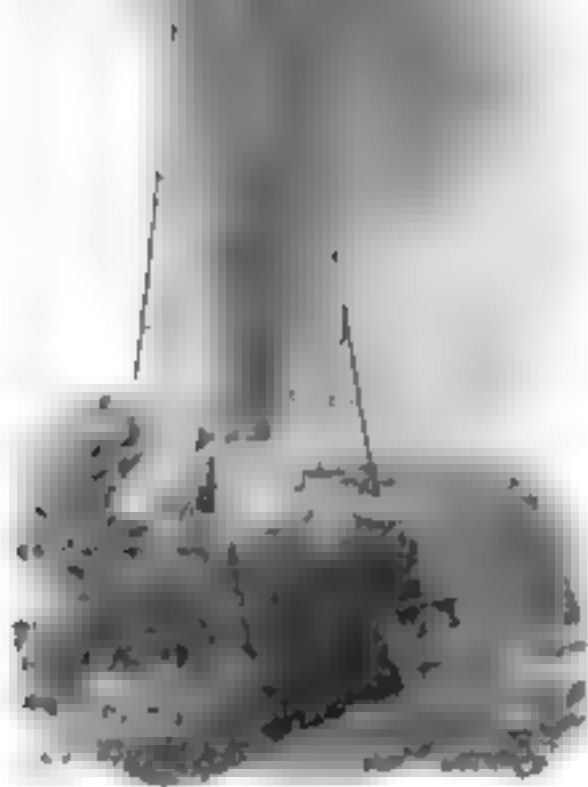
- 1 DECODER BOX INTERPRETS ELECTRIC SIGNALS
- 2 CAB SIGNAL LIGHTS
- 3 EMERGENCY VALVE TO FORESTALL AUTOMATIC BRAKES
- 4 DANGER WHISTLE

Duplicating cab signal is shown enlarged in the insert. A, B, C, D correspond to the wayside block signals.

Men who Blast

How Nitroglycerin, Strangest of Deadly Explosives, Is Used to Release Vast Stores of Oil

By JESSE F. GELDERS



An Oklahoma oil well a few seconds after a "shot" had transformed it from a dry hole into a steady flowing gusher. "Shooting" a well requires amazing nerve and cool-headedness. For nitroglycerin, the agent used, is among the most powerful explosives known.

TWO autos were racing each other along a road in northern Oklahoma. From the opposite direction appeared another car, carrying a rack of odd-looking tin cylinders at its side. The racers came abreast of each other just as they passed the third machine, and though it swerved to avoid a collision, the inside car grazed the rack, sent the cylinders clanging to the ground, and raced on without a stop.

Probably the speeders never knew how great a risk they had taken. That third car was loaded with 120 quarts of nitroglycerin. Its driver, Willis Hill, was on his way to perform his regular professional service of "shooting" an oil well.

Hill got out of his car and replaced the tin cylinders, which were empty shells. Then he drove on, the brightly painted letters on his auto flashing warnings to those who cared to read: "DANGER—EXPLOSIVES."

If the racers had smashed into him and caused his cargo to explode, no one, later, would ever have known exactly what happened. A junkman seeking the wreckage of three autos might have been lucky to find as sizeable a fragment as a bolt!

Hill himself recalls one story of an accident in Kansas. A nitro-driver, on his way to Neodesha,

was hailed by a pedestrian who wanted a ride.

"You see what I'm hauling," said the driver. "I'm not allowed to pick anybody up."

"I'll take a chance," the stranger insisted, and finally had his way.

About a mile beyond Independence the man began to think differently, and asked to be let out. He started walking, and the car drove on, passing over a small hill. A moment after it was out of sight, the pedestrian heard a terrific explosion. When he ran to the summit, the car was gone. Signs of wreckage indicated its fate, but what had caused the blast remained a mystery. Only the hill between had protected the pedestrian.

A well shooter's job is not for a nervous man. Hill's route to a well often leads him off the main highways on to dirt roads where the jolts seem to threaten instant disaster. But he always takes the bumps safely. It is a part of a well-shooter's work. Comparatively rough riding is made possible by his method of loading the car, performed with the same measured care which marks every phase of his job.

He lives by the rule, "Handle with care." He dies if he forgets it.

A few weeks ago Hill was shooting a well. When he reached his destination, the production superintendent immediately gave him the details of the situation. The hole was nearly 5,000 feet deep. It had penetrated into the sand in which oil was expected, and the baler had brought out slush with showings of oil. But it did not flow. So far, for all practical purposes, it was only a dry hole in the ground, dug at a cost of \$40,000.

NOT every oil well is shot. But hundreds of them are. Nobody has ever been to the bottom of one, to find out what happens when a charge of nitroglycerin is exploded in it, but the theory is that some petroleum-bearing sands are so dense or hard that they prevent the oil from flowing into the well. A blast shatters these crusts, lets the oil through, possibly opens new crevices to nearby pools.

Hill prepared to place a shot. He strung a wire cable from a well-llass in his car over a pulley at the derrick. He filled one of the empty shells with nitroglycerin, from the cans in which it had been hauled.

With the loaded shell, he walked toward the well, picking his way cautiously over pipes and timbers. He moved with care, for one misstep might have meant disaster.

With the shell hooked to the wire cable, he lowered it into the well. Nearing the bottom, it entered a mixture of oil and water, standing many yards deep in the hole. That would act as "tamping" when the nitroglycerin was finally discharged beneath it, like a submarine torpedo. When the shell was deposited on the bottom, two more shells were lowered upon it.

Then Hill prepared a "squib," a much smaller shell, with a detonating cap and a long fuse, all encased in a slim, tin cylinder, a high-powered messenger which would say "Go!" to the charge a half mile underground. He lit the fuse and dropped the squib into the hole.

Its journey was a long one, the last lap through a column of water. It was timed to explode after a safe interval on top of the last shell.

Hill stood a short distance from the derrick, alert.

"There it goes!" he said at last.

To others, there was practically no sound, not a tremor of the



A historical photograph—America's first oil well, drilled by E. L. Drake at Oil Creek, Pa., in 1859. Compare this crude wooden structure with the modern frame above.

for Liquid Gold

ground. But he was right. In a few moments there was a lashing at the mouth of the well, a sudden roar, and a black geyser spouted upward!

The drilling crew began to cheer. The roar grew fiercer, the stream shot higher, crashing against the top of the rig nearly a hundred feet above.

"It's cleaning itself all right," commented Hill.

The accumulation of oil seepage and water which had acted as clogging was being hurled up. When this waste had been thrown off, two of the drilling crew went up to theerrick with crowbars and turned a valve, which sent the fresh oil pouring through a pipe into storage tanks. The oil well was flowing!

The production of that well measured 400 barrels a day after it had settled to a steady flow. The forty thousand-dollar hole in the ground had been turned into a property worth about \$700,000.

Few men see so many fortunes made as a veteran well shooter. Sometimes he sees the despair of failure, too, for when there's no oil in the ground, nitroglycerin can't get there.

Willis Hill is a veteran, having shot wells for more than twenty years.

"I STARTED back in Wood County, Ohio," he recalls, "but the well-shooting business began long before that—in Pennsylvania soon after the Civil War.

"Those were the days of the 'moonlighters.' A man as Roberts had some patents covering well shooting, and everybody wanted the work done his way. The producers thought he was charging too much, and the night started. It was long my day, but I've heard some of the old-timers tell of it."

When Roberts learned that an owner had had a well shot without engaging him, he would hale the man to court and force him to pay for the use of the patents.

Then came the "moonlighters," well-shooters who did their work in secret. In the still of night their wagons rolled along the Pennsylvania roads, hauling nitroglycerin, and by the dim light of the moon they would

lower their shells and set them off.

But soon these jobs were discovered by the alert Roberts forces, and the producers again had to pay. Whereupon a more subtle plan was evolved.

The moonlighter would come with his nitroglycerin and shells, and put them into the well. Then, without detonating them, he would steal away. The owner would then send for Roberts. The latter's fees were fixed according to the amount of nitroglycerin used. The producer with his own shells, or "sleepers" already at the bottom of the well, would

engage Roberts to place a light shot. "We don't need much," he would say. "The formation is pretty shallow."

So Roberts' men would lower a small shell, ignorant that it rested on top of a much heavier charge, and when they fired their shell, the entire column was detonated! Sometimes the scheme was suspected, but Roberts was unable to put an end to this unlawful practice.

Right or wrong, moonlighting was re-



Willis Hill, veteran well shooter whose thrilling experiences probably won't tempt you to follow his dangerous footsteps! The slim cylinder is a squib used to detonate the nitroglycerin.



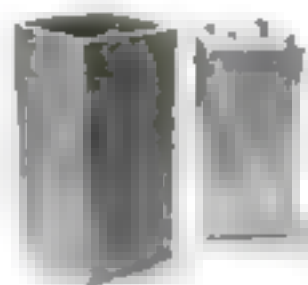
A "gusher." Drilling for oil, a daily flow of 35,000,000 cubic feet of gas was released in this oil well near Los Angeles, California.

garded as a romantic and not unworthy pursuit. Today most of the oil fraternity look back upon it and chuckle. Some of the men who were moonlighters in those early days are still active in various of field enterprises. One of them is a director of a bank central in oil financing.

HILL is reticent on the subject of disaster and accidents in well-shooting, but a partial list of men who had been engaged in shooting oil wells, published ten years ago and including 14 names, showed that sixteen of those men had been killed by explosions. The little booklet's descriptions of the sixteen fatal

explosions are terse. There is the name of a victim, the date, and the location. Then it adds, "at magazine," or "with dynamite," or "with car." Usually that was all that was known.

You can get some idea of the force of these explosions from what happened at one near Altoona, Kansas," Hill said. "A truckload blew up there and made buildings tremble. (Continued on page 125.)



This squib, lowered from the well, sets off the charge.



A car that usually has the road to itself. Willis Hill is shown here loading 150 quarts of nitroglycerin, packed in compartments as shown in the upper illustration, into his automobile.

Now—Traffic Rules for Aircraft

Government Regulations Provide No Speed Limit, but Give Balloons Right-of-Way over Planes and Require License Numbers to Be Visible

By H. C. DAVIS

DID you get your 1927 pilot's license? It's something new. Like the rules for auto drivers are the traffic rules for aircraft just issued for the first time by the Aeronautics Branch of the U. S. Department of Commerce. Reading them, it is easy to imagine the day when the air will be thick with airplanes, and traffic officers may direct the streams of fliers from captive balloons. Now right-of-way and license numbers belong as much to the air as to the motor road, as set forth in the Government's new rules.

First rule of all, you must have a pilot's license—without this you cannot take the air unless you would risk a \$300 fine. There may be as yet no "motor cops" of the air to blow a whistle and shout, "Pull over to that flier—let's see your license!" but it is well to carry on your person the certificate that proves you have passed an official pilot's examination.

A SIMPLE test is all that is required for a "private pilot's" license—one who flies for pleasure, not for pay. In figure B's, you circle two pylons and make several landings. Then a written examination proves you know how an airplane engine works, that a plane in distress at night fires a succession of Very lights, that a seaplane alighted in a fog must use a foghorn. Your test is less severe than that for "industrial pilots," who carry commodities, or for "transport pilots," who carry paid passengers.

Now you may fly, but take care that you observe the "rules of the road." See that plane about to cross your path, just emerged from the white cloud bank on your right? You must wait to let him by, he has the right-of-way. A moment, and he is past; the "road" is clear. There is no speed limit. Half a mile be-

low, the ground flits behind you as you speed along to the accompaniment of the roaring motor, drinking in the thrill of riding the air. Without warning, a plane

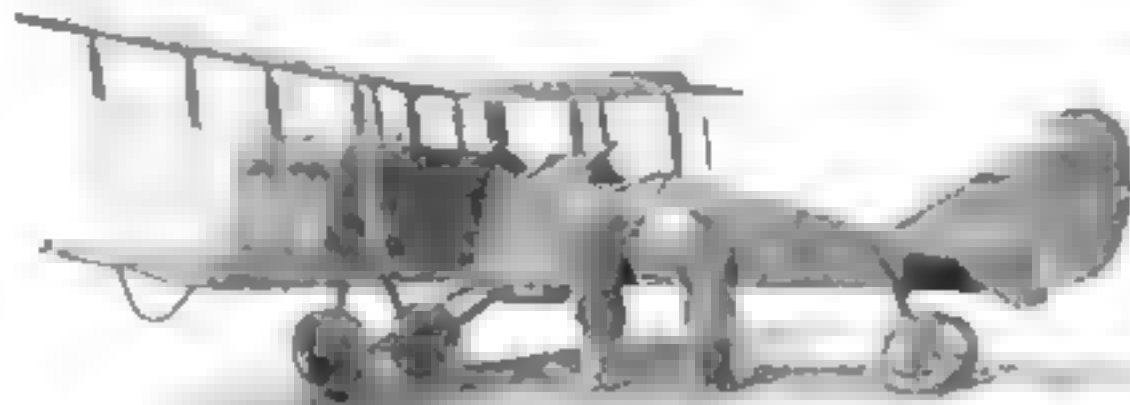
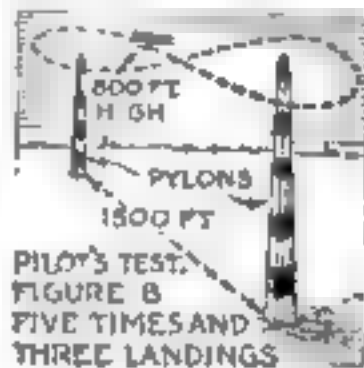
almost beneath you, is a field black with people and lined with parked cars. Don't fly below a thousand feet; that's the safety limit for an open-air crowd. A balloon ascension is in progress, the balloonist has just left the ground, and is wobbling skyward in his spherical ship. Turn out as you approach him, the right-of-way is his.

A GRACEFUL landing ends your day's flight. Home again, there is one thing more you must do. In a log that you keep for the purpose, make a brief record of your flight. Every three months you will send a duplicate of this log to the Secretary of Commerce at Washington. It must contain, also, notes of any repairs you have made on your plane, of the engine's running time, and of the result of the inspection you are required to make before each flight. Thus the Secretary has at hand the condition of every licensed plane in the country.

Like an automobile, every plane must now be registered and carry a license number. Huge figures painted on the wings and rudder serve as license plates and are visible from above or below and from either side. A letter prefix signifies the airplane's class.

"P" indicates a private craft, flown for pleasure; "C" designates a commercial plane, while aircraft owned by states or cities are marked with an "S." Government planes carry special letters, according to their department.

So an air pilot nowadays may lose his license because someone "took his number." If he violates any of the air traffic rules, his certificate may be suspended or taken away. Any passenger, or a Department of Commerce official, may demand to see his license at any time. These are a few of the new rules that are intended to make it safer to fly than to ride in an automobile.



Airplane No. 1—first plane licensed by the U. S. Department of Commerce under the new sky traffic rules. The plane is for Government use and "N" is the nationality mark of the United States as distinguished from other nations. The identification plate, which the two men are examining, must on all planes "be affixed to the fuselage in a prominent place." The sketch at right above shows the "private pilot's" license test; other sketches, above and below, illustrate new traffic rules for airplane pilots.



thunders straight toward you out of the mist ahead. Conolly you swerve to the right, and pass him.

Now you are overtaking another craft; the letters on his tail are easily visible. Pull over your rudder, sharply! for you must give him plenty of room as you pass on his right—at least 300 feet, the regulation is. He might strike a treacherous air current and be hurled against you if you were near him. Throttle wide open, you go by, leaving a semicircle of exhaust smoke around his plane.

You decide to alter your course. You turn to the left, dive through a cloud, and swoop down to a lower level. There,



Where men's lives hang by steel threads! Lining a 400-foot stack in New York City from a scaffold suspended inside

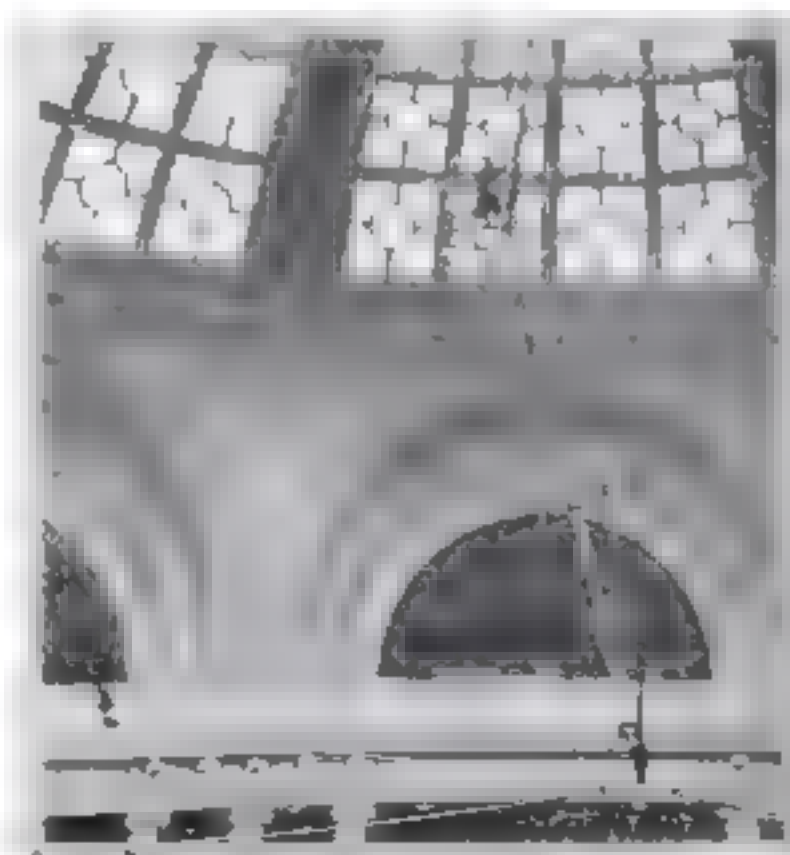
Marvels of Modern Scaffolding

How new steel-swung "trapezes" remove limitations to building construction and add thrills to worker's job

By ORVILLE H. KNABEN

CAN you imagine how it would feel to do your day's work standing on a swinging scaffold forty stories above the ground? Probably not. Neither could I until a few weeks ago, when I determined to find out what it would be like. Hoisted, by permission of a friendly skyscraper foreman, up through forty stories or so of steel, I climbed gingerly out upon a narrow board walk of two-by-ten-inch planks, and crept to the edge. I peered over the brink a fraction of a second—and then hurriedly grasped the iron guardrail.

Straight down, five hundred feet below, lay a ribbon of cold, hard sidewalk, and not a solitary thing between that sidewalk and me! If one of the planks should let go under my feet!—The thought sent chills down my spine, and I had a feeling as if a pound of lead had been poured into the pit of my stomach. I



Painting the huge dome of a San Francisco store: an ingenious cable and derrick arrangement swings the painter

drew back quickly, to look into the eyes of Barney, a strapping bricklayer. My face must have given me away. He was grinning.

"Oh, you'd get used to it," he said, good-naturedly. "We all do." We were watching the row of bricklayers and masons along the narrow walk, busily applying flesh and skin to the massive skeleton of steel, and seemingly oblivious to the precipice beneath them.

"WITH the tall buildings going up nowadays," explained Barney, "there's hundreds of us who spend every day of our working lives on these swinging trapezes. Sure, there's some danger, but after a while you don't think of it except to make sure that the rigging is all shipshape. Like a circus, isn't it? Looking up at our perch from below, you'd think we're risking our necks every minute. Maybe we are—but it's nothing to what



This scaffolding made room for the building of a new fire station. The old one was torn down, and the new one was built on the same site.



How a San Francisco contractor speeds up work on concrete chimneys: block and tackle on powerful outriggers lift the concrete forms.



Inspecting a scaffold ten stories above Wall Street, New York, one hour after they had been set.

I was a few years ago when they were building that new skyscraper in New York, and you can see it now. It was a very tall building, and it was the first one of its kind.

He moved up to the top of the tower, and he was the first one to go up. He was the first one to go up, and he was the first one to go up. He was the first one to go up, and he was the first one to go up.



The man on the high beam is a worker, looking down at the ground. The man on the high beam is a worker, looking down at the ground.

and I was the first one to go up. I was the first one to go up, and I was the first one to go up. I was the first one to go up, and I was the first one to go up.

and I was the first one to go up. I was the first one to go up, and I was the first one to go up. I was the first one to go up, and I was the first one to go up.

I was the first one to go up. I was the first one to go up, and I was the first one to go up. I was the first one to go up, and I was the first one to go up.

and I was the first one to go up. I was the first one to go up, and I was the first one to go up. I was the first one to go up, and I was the first one to go up.

I shall, when we think of skyscraper construction, we picture powerful steam shovels excavating. (Continued on page 128)

What Does Your Garage Cost You?

Here Are Practical Hints That Will Add to Its Convenience and Reduce Expenses

By

JOHN R. McMAHON

OUR first garage was an extra stall in a stable, said the remonstrating old-timer. "Its heating system consisted of the body heat given out by the livestock, which generally kept the radiator from freezing in winter. Lighting was by an oil lantern hung on a nail. We thought it quite perfect, until one night a pair of goats broke loose and staged a fight around the car. They smashed a big dent in the copper tubing of the radiator, drenched everything around with spouting water, and wrecked both the headlights."

"After that we didn't think our garage so good any more."

The first man who built a structure especially to house his car was considered snobbish as well as extravagant. The idea was harder to stomach because of a queer foreign name. There was hope when people began to take sides on the question whether to pronounce it *garajidge* or *garidge*.

Today almost every house has its garage. Realtors advertise, "Six rooms and garage," or they tell the world about a "Crest home with built-in garage." People sometimes advertise for a house with a "twelve-car garage," neglecting the most essential question whether the house should be at the seashore or on a mountain and have few or many rooms. In time we may expect to see a "Chick's sign," "Choice garage with home attached."

A CITY man in my neighborhood, spending his spare time building a home with his own hands. He started to erect the garage first, using stone masonry, and now has this structure about completed. It is an intelligent procedure, for the garage will serve admirably to store building materials during construction and will also make a first-class workshop.



Garages poorly located—behind the house or projecting porches in such a position that they are awkward to get in and out of—lose much in convenience. To save your car, garden and budget, place the garage where it can have an unobstructed drive, without sharp curves, to the street.

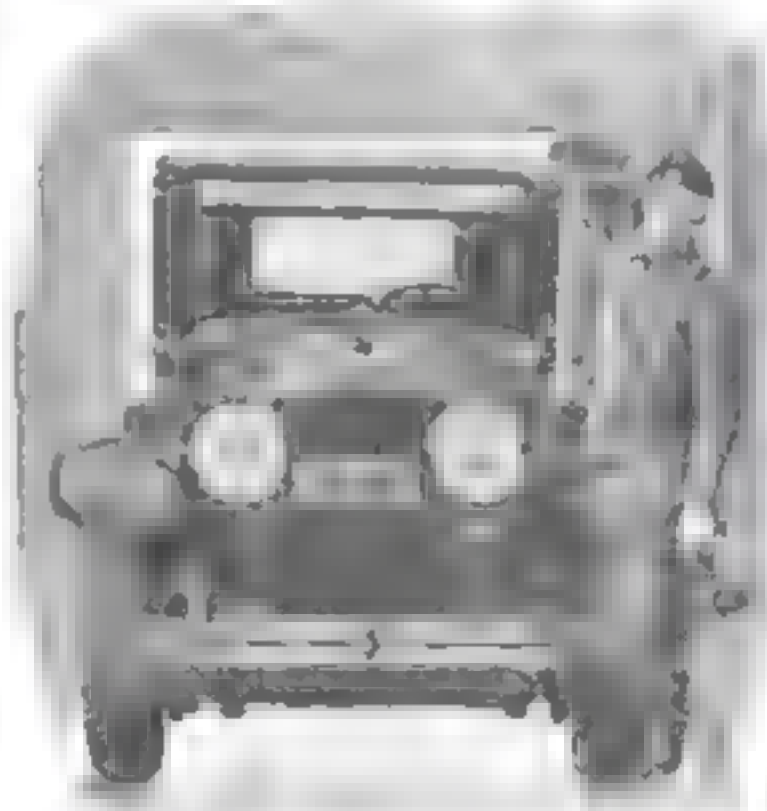
On this job there will be no spoiled cement, warped lumber, stolen tools or makeshift carpentry owing to lack of a convenient work place.

There are too many shoddily built, inconvenient home garages that discourage owners from giving proper attention to their cars, cause expense for trivial repairs that might be done on the premises, and fatten the purses of motor junk yard owners. Three walls, a door and roof do not make a garage. How about heat, water, light and a cement floor? Not to mention space for a work bench and the handiness of a private gas pump. It is usually a simple matter to tinker up a cheap, skimpy garage, equip it with conveniences and make it a place where you like to work; to give it an

attractive outside and an inside worth showing to visitors.

What size should a garage be? An inside width of ten feet is a tight fit, while an added foot or two in width gives fair clearance and room to get around the car. For housing two cars, double these figures. The overall length of automobiles, bumper-equipped, varies from about twelve to about eighteen feet. The latter figure will provide for any medium size car with leeway around the ends.

A factor that may govern length is the type of doors. The ordinary hinged doors opening outward permit full use of garage length, while doors that fold or slide inward may require an extra foot for free operation. Height from floor to ceiling should be eight feet or better, so that the car can be jacked up enough in touring top raised, and so on. A tackle hook in the ceiling whereby the engine head may be lifted is a handy detail.



Don't build your garage so small you can't work in it. Its size, of course, depends on ground available, but an inside width of ten feet is a tight fit. An added foot or so is better.

WINDOWS should be low so that light falls on machinery rather than on upholstery. In cold climates few and small windows are desirable to save heat. There will be plenty of light in good weather with main doors open, and at other times electric bulbs will supply enough illumination. With small sash anyone can afford to have them double against zero temperatures. One sash may be fitted on the outside and another on the inside of an ordinary window frame, leaving an air space between, and the sash may be held in place with screw bolts of metal. A fly screen for summer and an inner grille to discourage auto thieves are further refinements that cost little but add to comfort and security.

No doubt a garage built into a house is most convenient, but it entails greater fire risk and involves more careful installation than an adjoining or separate structure. It is well to learn in advance the requirements of any local building code and those of the insurance company that handles your policy. Take

your plans to the insurance people and follow their suggestions, otherwise you may be taxed a high premium and may also do a lot of worrying over a hazardous layout. The National Board of Fire Underwriters has issued a number of valuable pointers on the built-in garage, and the following paragraphs are a summary of these recommendations.

IN THE built-in garage, there should be no opening through the garage ceiling. If the building is frame, make the ceiling of three-fourths inch Portland cement or gypsum plaster on metal lath which weighs not less than three pounds a square yard. The lath should be well nailed with sixpenny nails clinched over, and it should lap six inches on walls all around. Above the ceiling there should be standard floor joists on sixteen-inch centers and a double floor of seven eighths-inch boards. Between top and bottom flooring, place a layer of asbestos or of noninflammable floor felt. The whole combination is by no means fire-proof; it will merely retard a fire for a period of one hour. Safety can be increased by using thicker plaster and putting a layer of asbestos directly under the metal lath.

If garage walls or partitions are frame, give the studs the same treatment as for the ceiling, that is, metal lath and plaster. It is an improvement to back-plaster between studs, whereby the lath is covered with mortar on both sides. This protects the metal from rust, besides adding to fire security. If walls or partitions do not embody wood, a lesser thickness is allowable: four inches for brick, hollow tile, concrete block or gypsum block, and three inches for reinforced concrete.

Again we must note that these are minimum, not to say skimpy provisions toward safety. It would be better to have thicker masonry, or at least to cover it inside with wire mesh or metal lath and plaster. A continuous sheet of metal-reinforced plaster safeguards against cracks and crumbling mortar between the units of masonry.

WIRE glass and metal frame-work are advised for doors and windows of the built-in garage. Only one opening between garage and house is permissible, and this should be equipped with a standard fire door of the swinging self-closing type. The door should have no glass in it, and it should never be propped or tied open. When the doorway connects directly with a cellar in which there is a furnace or heater, there must be a sill at least one foot higher than the level of the garage floor; or there must

be a vestibule with a second door leading into the cellar. The raised sill is explained by the fact that gasoline fumes accumulate near the ground and are checked from spreading by the sill barrier. The vestibule option mentioned above presumes that two doors will be equally protective

drainage of vapor, which is highly important, will take care of itself in a floor that is correctly sloped and equipped to carry away liquids.

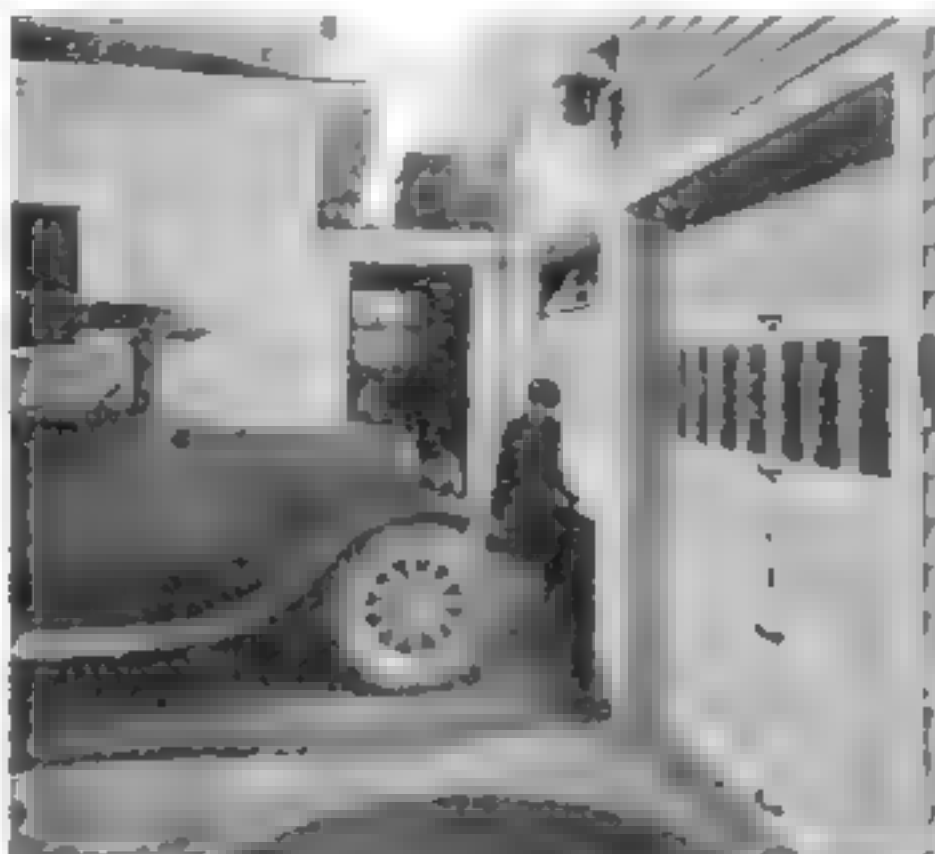
Of course there should be no stove or heater within the built-in garage, unless in a compartment as secure as the rest of the structure and having a fire door closing against a raised sill. Only electric light is allowable. There is a ban against floor pits. Any gas supply beyond that in the car tank and a five-gallon can must be kept in an underground tank at least three feet below the surface.

THE attached garage may be as convenient as the built-in, and by harmonizing its lines with those of the house it may appear part of the original dwelling. The house roof may be extended over it. An extra room, sun parlor or sleeping porch may be built above it. If the garage is no more than a box with a flat roof, it may be ornamented with a lattice coping and with flower boxes, and have ivy or flowering vines on its walls. The advantages of attachment to the house are obvious in heating, lighting and water supply, as well as convenient access and security against theft.

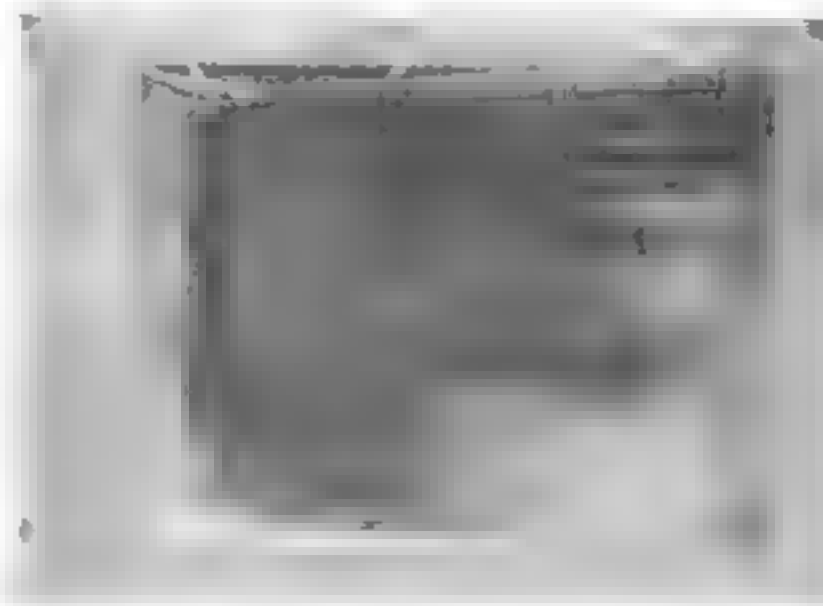
Some owners of the attached garage prefer to sacrifice a trifle of convenience for the sake of greater fire safety, by having no direct house entrance. At the same time they save the price of a fire door, which may amount to fifty dollars.

Whatever the location or general material, every "car stable" deserves a concrete floor and concrete or masonry foundations below the frost line. A proper floor can be easily cleaned of oil and grease with kerosene and a long-handled scrubbing brush; it can be swept out and hose-washed so that the owner can inspect the underside of his car even in his best clothes. Such a floor excludes vermin, is fire-safe, and makes it easy to move the car by hand. It needs a six-inch base of well tamped cinders or gravel, and over this a four-inch thickness of concrete, which may have a surface finish of rich, troweled cement half an inch or so in thickness.

THE best plan is to slope the floor from all sides toward a center drain trap of cast iron with perforated top plate, the drain being connected with a tile line extending outdoors. This job is not so difficult as it seems. Drive nails at the height of the finished floor in the four corners, extend cords from nails to center, which is one and one-half inches lower. Make the cinder base conform to cord slope, likewise the concrete layer. A plank straight edge will (Continued on page 33)



Have a center drain in the garage floor. You can make this by following diagonal lines, as shown here. (Upper photo) An "overhead" type of garage door. It is built in hinged sections that slide up out of the way on tracks.



Smooth-working hi-sliding doors are more convenient than out-swinging ones, and this picture, an inside view, shows how they can be made. The hinges, track and rollers are inside.

against spreading of the poisonous vapor. The floor of the built-in garage should be concrete, with a slope that will drain gas, oil and water outside. The invisible

is one and one-half inches lower. Make the cinder base conform to cord slope, likewise the concrete layer. A plank straight edge will

Shall We Scrap *the* Yardstick?

With two kinds of miles, three pounds, many arbitrary units, our measuring system is called antiquated

By ALDEN P. ARMAGNAC

ARR-MAY! Rah! Rah! *TEAM!* Across the gridiron, hurled from the throats of the cadets that pack the stand, comes the Million-meter Yell. There is a history behind it. Shortest football cheer of West Point's repertoire, the Million-meter Yell is named after a diminutive fragment of a measuring scale based on a mysterious beam of red light—a scale universally known as the metric system.

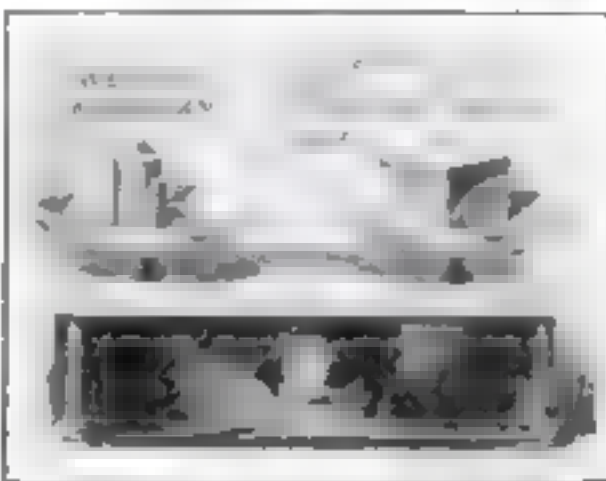
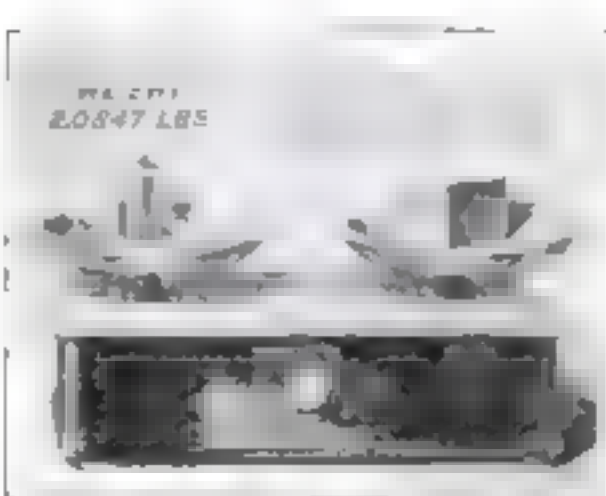
When you weigh yourself on a slot machine, or stop your car to read "4 Miles to Blankville," you are using specimens of a time-honored collection of standards that is the English system of weights and measures. Yet there is talk of changing them. Tomorrow your weighing machine may tell you that you weigh seventy kilograms, the signpost may read, "Blankville—6 Kilometers."

In Congress resolutions have been introduced that, if passed, would put the metric system in everyday use throughout the country. The metric system, say its advocates, is uniform, it is easy to learn and easy to use; and every civilized country but two—England and the United States—is using it. Shall we adopt it?

You are laden down with three kinds of weights. You use an "avoirdupois pound" to weigh all ordinary things; a lighter "troy pound" for gold, silver and jewels; and the same pound, disguised under the name of "apothecaries' pound" and differently divided, to measure out prescriptions at the corner drug store. Besides your two distinct miles, you have the furlong, span, hand, pennyweight, scruple, line and firkn to annoy you.

ENGLAND'S gallon and ours are not the same. The gas station attendant at our Canadian border urges motorists to replenish their tanks before they cross the line. "Better fill 'er up—it'll cost you several cents more a gallon on the other side." He neglects to add that the Imperial gallon of Britain and Canada contains nearly a quart more than ours. For that matter, our yards and inches are different. It is not generally known that in 1893 the meter became the official standard of this country, and that now by law the U. S. yard and inch are redefined as fractions of a meter. For, though other units may vary, a meter is a meter the world over.

In the metric system, the meter—a little longer than our yard—is the



The metric system is easy to use because its units of volume, length and weight bear the simple relationship shown above. Contrast this with the complicated decimals you get in reckoning the same relationship in our "English" system, shown in the upper picture.

sole standard. Volume and weight measures are ingeniously derived from it. A centimeter decimal of the meter yields the "cubic centimeter" that, with its big brother, the "liter," measures all volumes. The weight of one "c. c.," or cubic centimeter, of pure water is a "gram," fundamental metric unit of weight.

And there you have the whole system

in its amazing simplicity. Your pound and quart are hardly on speaking terms with each other; your inch will acknowledge only a casual relationship with either. But in the metric system a given volume of water or of anything else has an instantly calculable weight and size. To a schoolboy, that means finishing his lessons in a few minutes; to industry, an incalculable saving in brain power to be diverted to other useful fields.

MOREOVER, urge the metric supporters, all metric units are divided in tens. You think in tens, they say. You do all your figuring with the symbols 1 2 3 4 5 6 7 8 9 0. Therefore, why not be consistent and use weights and measures that, like your decimal coinage, will be in harmony with this number system? It's an unusual man who can say offhand how many square feet there are in an acre; but any French schoolboy will tell you that a hectare, the corresponding metric unit, contains a thousand square meters. It is an easy figure to remember, and a handy one to figure with.

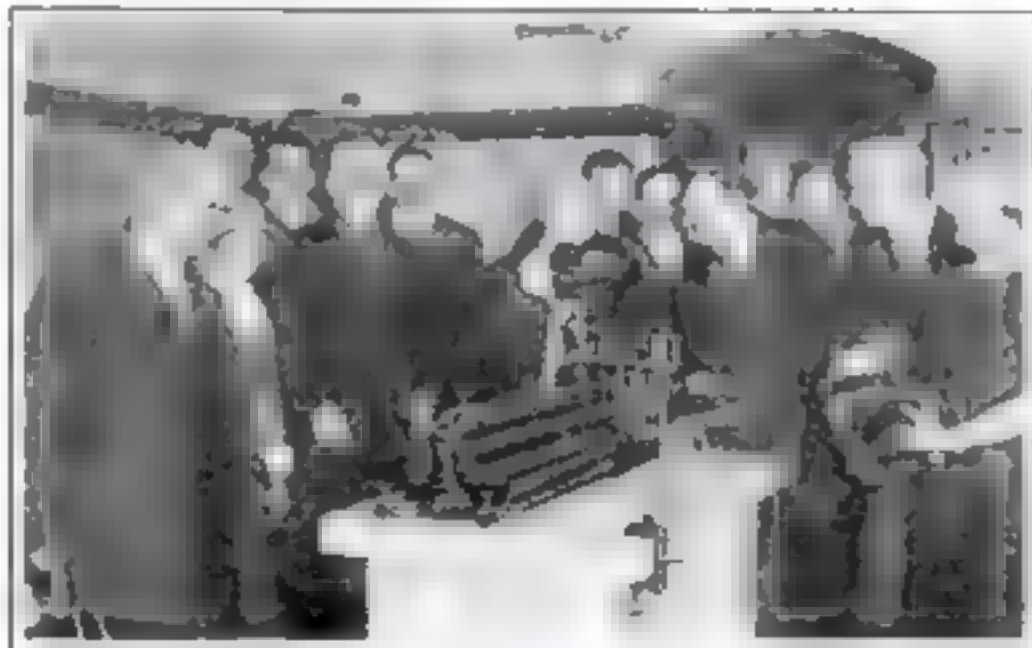
An average-sized drop of water and a plump grain of wheat are the original sources of two of our smallest measures of volume and weight, the minim and the grain. Is it surprising that our scientists abandoned that system and now use the metric system for their delicate laboratory work? The chemist who makes an error of half a teaspoonful stands an excellent chance of being blown into eternity.

When it comes to measuring length, the English system as commonly used can provide nothing smaller than the inch—immediately divided into grotesque fractions such as thirty-seconds and sixty-fourths. Lately, some geniuses have been using decimal fractions of an inch in fine manufacturing work; but it is incongruous to write a measurement

in feet in twelfths of a foot, and in decimals of the twelfths of a foot. In the metric system, completely decimalized, the infinitesimally small "micron" measures light waves only a billionth of a meter long. Yet this value in written figures may be tacked directly on the end of a metric length equalling several miles without incongruity.

As early as 1583, Simon Stevin of Belgium published a book, "La Disme," in which he set forth the benefits of a decimal system of weights and measures. But it was not until

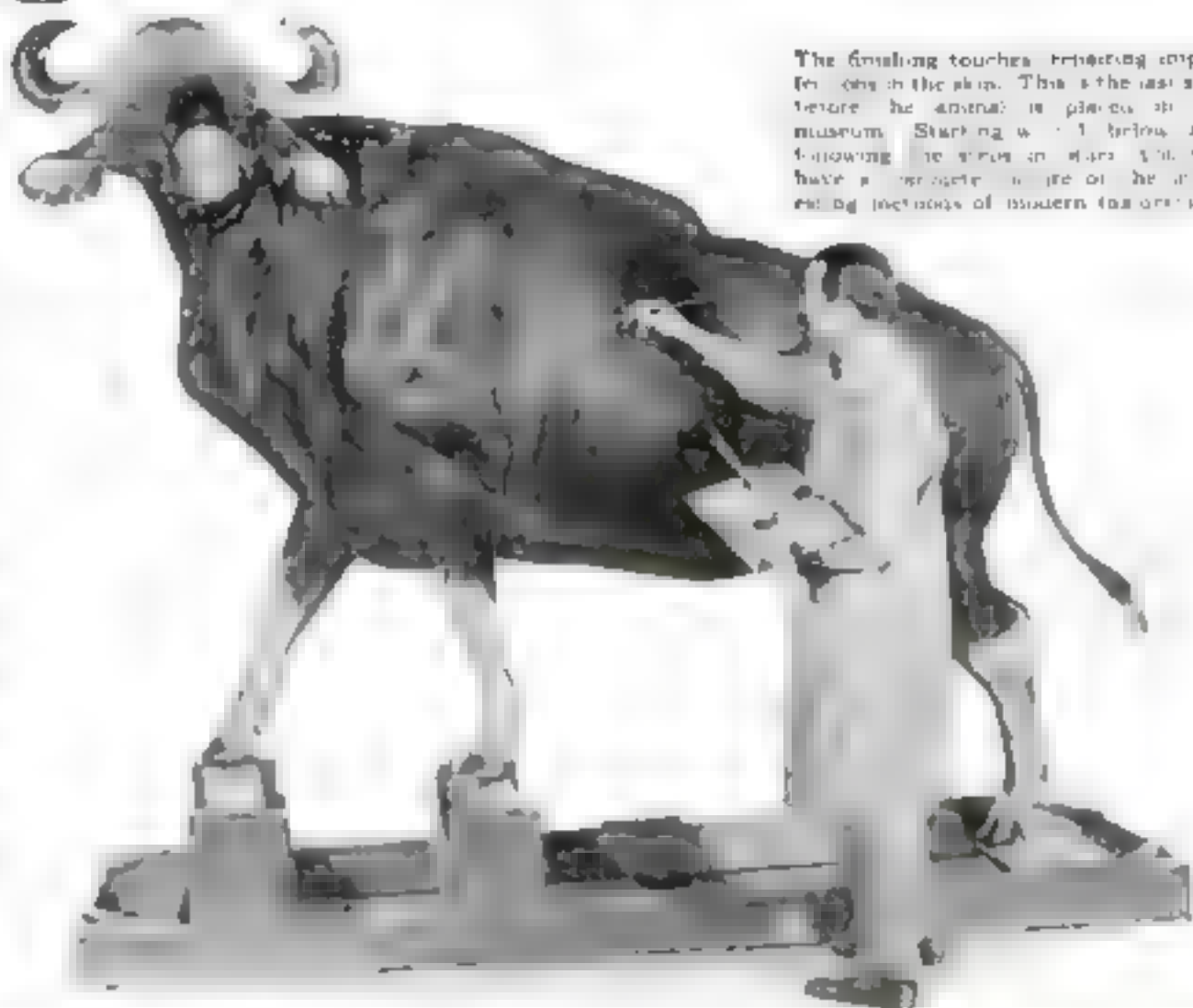
(continued on page 130)



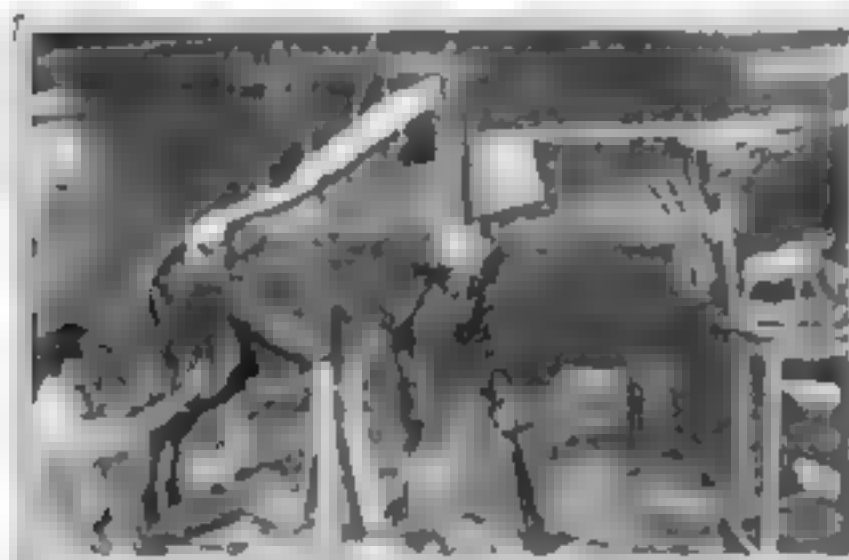
At the U. S. Bureau of Standards is kept a copy of the world's standard meter, rigidly guarded at Sevres, France. A group of scientists is seen here examining it.

The Strangest Art in the World

How Taxidermy Makes Animals "Live Again," Shown in a Remarkable Set of Photos of the late Carl Akeley's Methods—The Pictures Are the First to Show the Complete Operation and Took Seven Months to Obtain—The Animal Is an East Indian Wild Ox



The finishing touches, rejecting imperfections in the skin. This is the last step before the animal is placed in the museum. Starting with a billy and following the skin inwards, it will have a complete picture of the animal's life by means of modern taxidermy.



1 The first step is the construction of an "armature" or framework of boards, using some of the animal's bones. This is then covered with wire netting, bulging to approximate the size of the animal. Note the model of the finished figure, at right.



2 Over the wire netting is then roughly applied a coat of plaster of Paris, to serve as a base for the next coat of modeling clay. This next step, modeling with clay, is the most important of the whole process.



3 Left: Applying the modeling clay to the plaster of Paris. Every muscle and vein of the ox is clearly emphasized.

4 The finished clay model is a fine piece of sculpture. It looks as though all it needs is the skin but there still remains much work to be done.



5 Right) Over the finished clay model, plaster is applied, which, when hardened, can be removed as a plaster mold, having the unprint of the animal on its inside. This plaster mold is in four sections, to facilitate its removal.



7 (Below) Now the inside of each section of the planter mold is stuffed tightly with a combination of fabric, wire mesh and paper maché made rigid with abelac, which forms a strong "mammoth"



6 (Left) Thoroughly hardened, the plaster mold is removed in sections. The original clay model is from now on of no importance. In fact, in this case its head was demolished to remove the plaster mold intact.



8 (Above) The manikin "walls," still with the plaster mold covering them on the outside, are now braced with wooden crosspieces on the inside, and the sections fastened together. The plaster is then soaked with water to remove it from the manikin.



9 (Above) Removing plaster mold from the specimen, after softening with water



11 The last step—clothing the reconstructed beast with his original pelt, which is fitted tightly to the body's ridges and hollows. Even the tall and slender legs are cunningly sewn up so that not a seam is discernible. Now, at last, the great stranger in all his majesty

10 Plaster mold removed, the finished manikin stands forth, hollow but strong. Veins and muscles protrude grotesquely from its "skin" of mottled macké and shellac.

This poster
warning was directed by
John J. Jones, American War
League of National Liberty

Bare Hands

By H. H. THORNE DANIEL

Illustrated by J. Clinton Shepherd

PARKER and Thornton, partners in a Seattle engineering firm, and Williams, a young naval architect, were enjoying a pleasure cruise among the Aleutian Islands in the latter's yawl when, with their deck hand, Kelly, they fell into the hands of Kinga Joe, a notorious half-breed seal poacher, and his crew of native Aleuts. Undecided whether to murder his captives, Kinga Joe imprisoned them in their own yawl; then, having placed Oomak and two other Aleuts in charge, he returned to his schooner. Together the two ships sailed westward. Separated from the schooner in a fog, the yawl was wrecked on the rocks. Two of the Aleuts made away in a small boat, while the four white men and Oomak struggled through the sea to the beach of a desolate and apparently uninhabited island. Thornton, the natural leader of the group, managed to build a fire without matches, then directed his comrades—Parker, Williams and Kelly—in the task of providing shelter in a shallow cave and of catching birds for food. Oomak, mysteriously frightened and nervous, explained that the place was known as Devil's Island, inhabited by devils whom Kinga Joe occasionally appeased with gifts. Later, as the men huddled about the fire, pondering their fate, suddenly there arose a weird and dreadful cry that echoed across the cliffs, finally disappearing as mysteriously as it had come. Oomak, who inspiring groveled in the sand. All this was told in the first installment published in last month's issue of POPULAR SCIENCE MONTHLY. Now read on.

THEY listened again for the cry, but it had gone. They crouched close to the fire and shivered, though they were warm. They spoke in guarded tones, and glanced about, fearful lest some enemy might creep upon them. But the sound was not renewed, and gradually they recovered their assurance and their reasoning faculties.

"Could it have been an animal?" asked Parker, nervously.

"I doubt it," replied Thornton. "I have been frightened by bobcats, and I've heard coyotes and wolves. I've heard mountain lions and a lot of other things that make weird sounds, but what we heard was nothing like those. It sounded human to me—won't, terribly human. Yet Oomak says the island is uninhabited."

He paused.

"Oh, the devil!" he went on. "Who'll go with me? I'm going to see if I can't find some trace of it."

The group fell rather sheepishly quiet, until Kelly frowned and got to his feet.

"I'll go," he announced. "But I want a club."

"So do I," admitted Thornton.

But though they searched for an hour they could find no trace of what had made the sound, and so returned to the fire, still mystified. Thornton sat beside the fire, and presently found himself pondering again the difficulties that faced them.

He tried to think of elemental things which they most required. "Fire?" he thought. "We have it. That's settled. Food? That's easy. Shelter? O K., until we can find a better place. Clothes? Yes, rabbits. We have lots of them. Then what?" He sat staring at the fire. "Tools," he said finally, aloud.

"Tools?" repeated Parker. "What are you talking about?"

Thornton was about to reply when Williams and Kelly came trudging up with great armfuls of wood that they threw on the

Here is a brand-new kind of novel—A thrilling romance of ingenuity and scientific skill put to a supreme test on a desolate Arctic island

growing woodpile. Oomak, having cleaned his fish, brought them to the fire with a long green stick thrust through them, so they could be smoked above the blaze.

"We need tools in order to live," said Thornton, returning to the subject. "And we can find them, too, or make them—somehow."

"Do what?" asked Williams, who had heard only the end of Thornton's remark.

"Tools," repeated Thornton. "We have to make some. Then we have to get rabbits and make clothes of their skins."

"How will you tan the skins?" asked Williams.

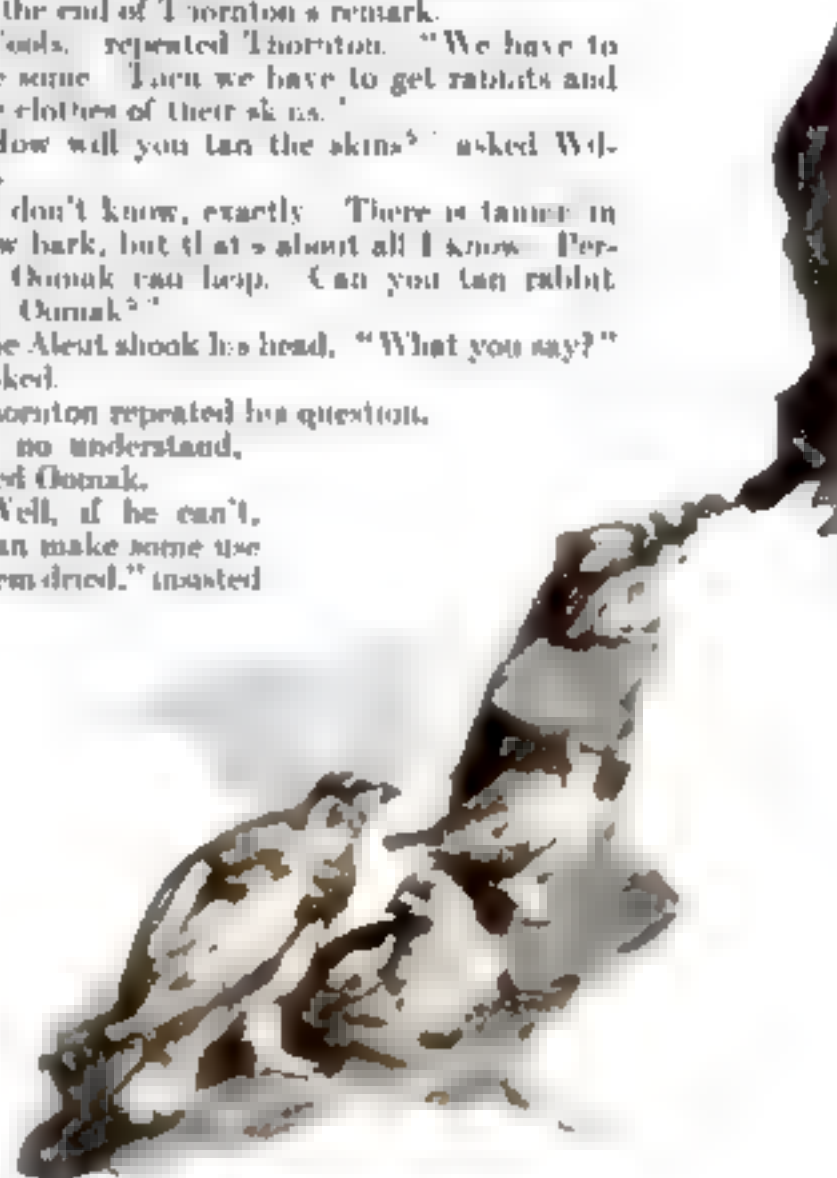
"I don't know, exactly. There is tanner in willow bark, but that's about all I know. Perhaps Oomak can help. Can you tan rabbit skins, Oomak?"

The Aleut shook his head. "What you say?" he asked.

Thornton repeated his question.

"I no understand," replied Oomak.

"Well, if he can't, we can make some use of them dried," insisted



Thornton. "Now listen. It's getting late, and we'd better not get far from here tonight. But we're going to get out of this fix. How, I don't know. But first we need clothes. Second, we need tools. We'll start first thing in the morning to get both."

Despite the fire burning before the shallow cave everyone was cold that night. But the fire at least kept them from freezing. In the morning they were up with the earliest dawn, ready to start on their quest.

Oomak refused to leave the imagined safety of the fire and the cave, and Parker, the impractical theorist, obviously would not be highly useful on such an expedition as was planned. Furthermore, he belittled their efforts.

"Ridiculous," he sneered. "Suppose you made your tools,



Williams went off to the south along the shore, and Parker stayed at camp. Thornton went up the ravine to the top of a small hill, and saw that the island was alone in the vast expanse of sea. No land was visible in any direction, and the island itself was small—hardly more than four or five miles long by half as wide. Here and there were clumps of trees, mostly along the edge of the cliff above their camp. For most of the rest of its extent the ground was covered with moss and little clumps of grass and willow. Rabbits scurried here and there. Birds flew overhead. But he saw no signs of any large animals or of men. Certainly the island was uninhabited.

although you can't. But even if you had them, what good would they do you? What we need most is the fire and food. And we ought to watch for passing ships. One will be along soon, and we can signal it. You'll waste your time and run needless risks wandering about unarmed. Count me out. I'll do something useful.

No one replied, but both Williams and Kelly seemed more willing to follow Thornton's suggestion than Parker's. So it was that just as the sun rose the three started on their exploring trip. At first they planned to go together for protection, then decided not to; so, armed with clubs, Thornton took himself off up the ravine through which the stream flowed, while Kelly went off to the north along the shore, and Williams to the south.

FOR a quarter of an hour Thornton struggled up the narrow steep ravine. He went wary, for he had no idea of what he might face. Once out of the ravine he found himself on a high and more or less level stretch. He climbed to the top of a small hill, and saw that the island was alone in the vast expanse of sea. No land was visible in any direction, and the island itself was small—hardly more than four or five miles long by half as wide. Here and there were clumps of trees, mostly along the edge of the cliff above their camp. For most of the rest of its extent the ground was covered with moss and little clumps of grass and willow. Rabbits scurried here and there. Birds flew overhead. But he saw no signs of any large animals or of men. Certainly the island was uninhabited.

It was noon before the three explorers returned to camp. None of them had seen any signs of habitation or of Oomak's devils. Thornton was the first to arrive, and in his hands were three rabbits. He found that Parker had done nothing but wonder how to erect a signal, while Oomak had kept the fire going. But Thornton pretended not to notice Parker's inactivity. Instead, he held his rabbits up proudly as he came limping

back to the fire, where he sat for a time soaking up the heat.

"The little rascals," he said finally. "I saw plenty of them, but I never knew how hard they were to catch."

Oomak grinned as he started skinning them with his teeth. It was amazing to the white men to see how simple he performed the task. Half a dozen lutes, and he had broken the skin of the first one. He stripped it from the hind legs of the animal, and began to peel it off, turning it inside out as he did so. The skin came off whole without a break, save where he had bitten. Next he ran to a willow bush that grew a little way off, broke several branches, returned, and almost in a moment had a branch bent double and thrust within the skin distending it. He set it up against a rock and began on the second rabbit.

"THAT looks simple," commented Thornton, "but I doubt if you could do it, Parker."

"Do it?" asked Parker. "Of course I couldn't do it. It's disgusting the way he bites the skin."

"It may be disgusting," replied Thornton, "but you'll be mighty glad to get a pair of pants made out of rabbit skins. There are plenty here to make

clothes for us, if we can catch them.

"Waste of time," objected Parker. "We'll be picked up long before you can accomplish that. Did you get anything useful?"

"A few bits of stone that we may be able to use," replied Thornton. "But there weren't many up there. Mostly covered with grass and moss, once I got out of the ravine. There comes Williams. Maybe he has something."

Williams came shuffling in with one sandal nearly off, and with his arms full of sticks and stones.

"Saw a seal," he shouted, "but I couldn't get him."

"What luck?" asked Thornton in return.

"So so," replied Williams, stopping beside the fire and dropping a strange assortment of oddly shaped stones and sticks. In one stout branch he had thrust a sharp stone, making a very crude axe. The other stones were of many shapes and sizes—some sharp, some pointed, some thin and capable of being copped.

"Pretty good," offered Thornton, while Parker looked on doubtfully.

"Good for what?" asked Parker, disparagingly.

Thornton smiled.

"Good if we can't do better," he replied. "We might worry a tree down with that axe, if our patience held and the stone didn't break."

He picked up a small, thin rock and broke it on another. It splintered to a fine, sharp point, and he picked up one of Oomak's fire-sharpened spears.

"You can make a spearhead out of that," suggested Parker, despite his lack of enthusiasm.

"That's what I thought," replied Thornton, "and that's what Williams brought it in for."

Parker picked up another piece and turned it over and over.

"Of course," he began, "you're wasting your time, for you won't need it, but this stone can be made into a fairly good sort

of blade. It's obsidian." He held it up to the sunlight. "You see? Where it is broken it shows a conchoidal fracture, like that of glass. If I remember correctly it was first discovered in Ethiopia in Greek times, by one Obsius, and here we find it on this desolate island. It's volcanic in origin. It seems to me," he went on, "that I have read something about the uses to which savage peoples have put it. It is brittle, of course, and so you can't use it for the tools you want so badly. Still, natives sometimes use it for arrowheads, and even for knives and razors."

WILLIAMS looked at Parker in surprise.

"Well, where did you learn all that?" he asked.

"Oh, I've taken some interest in geology," replied Parker. "Never used it much, any more than you'll use this obsidian, but it interested me."

They heard Kelly shout as he appeared from the big pile of boulders at their backs, and in a moment he dropped a double armful of vari-shaped stones at their feet.

"What did you find,

Kelly?" asked Thornton, turning hopefully to the deck hand.

"Not much," replied the sailor. "It's awful rocky up that way. There ain't a thing for a mile but big rocks that's all tumbled over. And then there's a little inlet, and I found these almost all in one place. Lots more of the same stuff, but there ain't a sharp one in the lot. The rock ain't hard enough. Not much good for tools. I'd say."

Parker carelessly picked up one of the stones that Kelly had dropped, and looked at it. He turned it over and looked again.

"**MAGNETITE**," he announced. "With all the time in the world you can't make tools out of this. Obsidian may serve a bit, if we are here long enough. But not this stuff."

He pitched the stone he held over his shoulder.

Thornton stared at Parker in amazement. For a moment he gulped and could say nothing.

"Magnetite!" he finally gasped. "Are you sure?"

"Why, certainly," replied Parker, testily. "It's an exceedingly common thing. Occurs all over the world, and sometimes forms deposits important as iron ore. It's an oxide of iron. Fe₃O₄, I believe."

Thornton seized a bit of the ore and turned it over. He scratched it with another bit, and a black line showed on it.

"By George," he cried, "you're right! That's wonderful!"

"It would be," replied Parker, raising his eyebrows. "if the deposit were of any size and if it were closer to civilization. But as it is, it's worthless. Small deposit, undoubtedly, even if the whole island were made of it, and there's too much elsewhere in the world. It's entirely worthless."

"Worthless?" shouted Thornton, springing to his feet.

"Worthless? It's everything. Now we can make real tools!"

The group about him looked blankly at his delighted face.

"Out of what?" asked Williams.

"Out of iron," shouted Thornton. "Out of steel!" He waved his bit of magnetite in the air. "All we have to do is to smelt it!"

"Ridiculous," scoffed Parker.

"Why?" asked Williams. "Can't it be done?"

"Of course it can be done," admitted Parker, "in a blast furnace. But we have no blast furnace."

"Then by George, we'll have one!" shouted Thornton.

"Iron. Steel! And watch me make tools!"



Omek now had a spear tipped with obsidian, and with this he caught fish in the stream. The sharp spear head was made from bits of the volcanic rock which Williams had found on the island.

"Tommyrot," insisted Parker.

Thornton's excitement over the discovery of the magnetite communicated itself to Williams and Kelly, although Parker still jeered.

"Ridiculous," he repeated. "Perfectly ridiculous. You'll sweat and labor and fume and accomplish nothing."

"Don't be so sure!" replied Thornton. "Do you mean to tell us that we can't do what any number of savage tribes can do? Do you think for a moment we can't smelt iron as well as the Masai and Kikuyu and other native tribes in Africa? They make spears and swords from metal they smelt themselves. If they can do it, certainly we can, make axes and knives and other simple tools."

"**NONSENSE**," objected Parker. "Don't try to tell me that African natives can reduce iron ore and make their spears. They are probably made in Sheffield and sent out to African trading posts. It's ridiculous to suppose that savages have enough knowledge and mechanical ability to perform so complicated a task. I for one, don't believe they ever did such a thing."

That's merely another of your theories," insisted Thornton. "If you had ever interested yourself in such matters, and had ever gone through a really fine museum, the American Museum of Natural History in New York for a starter, or the National Museum in Washington—you would know that you are wrong. I have talked with men who have studied the natives, and I know just how they reduce their ore and work their metal. And if I didn't, I could work out methods of my own. The trouble with you is that you require a laboratory and all the equipment in the world before you can think of attempting so simple a task as smelting iron ore."

He turned from Parker to the others.

"What shall our first iron tool be?" he asked.

"An axe," replied Williams.

Thornton smiled and shook his head.

"Wrong," he announced. "It will be a hammer."

Parker laughed sarcastically.

"A highly important tool," he remarked, "to go to so much trouble to secure."

BUT Thornton paid no attention to the remark. He realized that his own viewpoint and Parker's differed sharply. He knew, too, that they were likely to be together on the island for a considerable time. His experience in the wilds had shown him that sharp divergences of opinion sometimes became almost unbearable. He knew even of instances where men had killed their best friends in sudden fits of uncontrollable temper gradually aroused by long disagreements over trifling matters. But Parker, he knew, had no conception of such serious difficulties, and probably would continue to be biting and sarcastic, derisive, mocking. Therefore, Thornton thought, he himself would have to carry the major part of the burden, would have to be forbearing and considerate. Already he had given way to anger and direct speech. He must be more careful, and more considerate. It was not Parker's fault that he was a misfit in their present predicament. He was a highly specialized creature intended for and very successful under the conditions which, until now, had always surrounded him. So Thornton paid no attention to Parker's sarcasm, and explained his viewpoint to Williams and Kelly.

"The first tool we manage to make," he remarked, "is bound

to be crude—that's to be expected."
"No doubt about it," interjected Parker.

"And so," went on Thornton, "we want to make one that will be of some use to us in making the second one a more finished product. For that job, nothing could be more useful than a hammer."

"Right," nodded Williams. "Quite right."

"**T**HEN what?" asked Kelly.
"Anything," replied Thornton. "Axes, knives, fishhooks, spearheads, arrowheads, adzes—we'll need adzes more than anything else if we have to build a boat."

"Build a boat?" asked Williams.

"Why not?" asked Thornton. "With tools and nails—"

"Sure enough," admitted Kelly. "We can make nails."

"Certainly, if you can make anything," sneered Parker. "but don't you think that before you make all these tools you had better see if you can get the iron? I have my doubts. It really requires a blast furnace."

"Then we start at once making a blast furnace," insisted Thornton.

But the blast furnace was not so easy to build as it at first seemed. It was not difficult to erect a chimneylike structure five or six feet high, nor was it troublesome to line it with clay taken from the stream. But some apparatus had to be constructed to force air into the base of it, and in order to make bellows, skins were required. Furthermore, the whole party was beginning to suffer from the effects of cold, and it was obvious that skins, for clothes and for bellows, had to be secured before the other work could be continued. And that took time.

For the next five or six days Thornton, Williams, and Kelly hunted for rabbits. They built deadfalls, and utilizing sinews that Oomak had cut with a bit of obsidian from the three rabbits Thornton had caught earlier, they made snares. They even killed a few of the little animals with rocks. These they turned over to Oomak. He skinned them with obsidian knives. He dried the skins on bent willow branches. He prepared still other sinews for still more snares. The skins were dried, smoked, scraped and crudely tanned with water and pounded willow bark, and finally Oomak began to sew them together with needles made of fish bones and with sinews he had prepared for the purpose.

Devoting their entire time, as they did, to catching and killing rabbits, the three hunters brought in skins by the dozen, and soon by the score. And they needed to, for Oomak required forty skins for a costume. Still, at the end of the fifth day the Aleut gazed about at the collection of skins and agreed that no more were required.

The costumes were not beautiful, for Oomak made them with fur turned in. But they were comfortable and warm—almost too warm for all save Parker, whose activities were limited almost wholly to watching the blaze. In addition, sandals made of rabbit skin with the fur turned in, and with pieces of bark for the soles, made it possible for the whole group to wander about more or less heedless of stones.

The food problem simplified itself. Practice increased their skill in hunting ptarmigan, which they chased across the rocks and killed with clubs. Oomak now had a spear tipped with obsidian, and with this he caught fish in the stream. Rabbit

Next Month!

FIRE-SHY

By

EDMUND M. LITTELL

Those of you who enjoyed "Midge" in our March issue will be thrilled by this new short story by the same author. You'll recognize some of the same steel-hardened, lovable characters in new and tensely dramatic situations.

meat became extensively plentiful, and Oomak, in what few spare moments he had, dried it and smoked it and made supports of branches from which the meat was hung. Obviously they would not starve, but could they, with no more to add them than they had, supply themselves with metal and so make the huge step from the Stone Age to the Age of Iron?

It was not until they had dressed themselves in the rabbit skin clothing that they finally went to work, once more, on the blast furnace. The stone chimney, which was the furnace, already had been completed, and now it remained only to construct the bellows. Thornton recalled having seen pictures of bellows used for smelting by the natives of Africa, and set about to duplicate those simple affairs. They brought clay from the stream, dumped it on the ground about the furnace, and molded it into half a dozen heavy, bowl-like contrivances, with thick walls six or eight inches high. They

punched two holes through the walls of each of these bowls—one on the side toward the furnace, where they made a clay pipe by covering a round stick with clay and then withdrawing the stick. This pipe led to the wall of the furnace where a hole through the stones allowed the pipe to pass. The second hole was somewhat larger, and merely led through the wall of the bowl, being covered on the inside by a flap of rabbit skin, one edge of which was pegged to the wall by twigs. Across the top of each of the bowls, which was hardly more than a foot wide, a loose covering of rabbit skin was fastened. By alternately lifting and pressing down on this loose covering, the air was drawn through the rabbit skin valve and expelled through the clay pipe into the furnace six inches above the bottom of the stone wall.

"**Y**OU amuse me," announced Parker as he stood idly by, watching Thornton pumping away at the first of the bellows to be completed. "You can't get pressure enough with such a contrivance to melt butter, much less ore."

"You don't need much pressure for a furnace only five feet high," replied Thornton, in an conciliatory tone as he could assume. "I'll bet we can make it work."

"Humph," grunted Parker. "What fuel will you use?"

"Charcoal would be fine," replied Thornton, "but I'm not sure I know how to make it. So we may have to use wood."

"You can't use wood," objected Parker. "It won't work. You'll have to make charcoal. It is not difficult."

"How does one go about it?"

"Perfectly simple," explained Parker. "I've often seen it made by the crudest possible method, and I've made it myself in laboratories. One method I have seen used in Europe, and which dates back to a very remote period, consists in piling billets of wood on their ends to form a conical pile, openings being left at the bottom to admit air, with a central shaft to serve as a flue. The whole is covered with turf or moistened soil. The firing is begun at the bottom of the flue, and gradually spreads outward and upward. The success of the operation—both as to the intrinsic value of the product and its amount—depends upon the rate of combustion. Wood becomes brown at 220 degrees Centigrade. Charcoal made at 300 degrees inflames readily at 380, but if it is made at a higher temperature it does not fire until heated to about 700 degrees. Therefore, for use in smelt— (Continued on page 110)

"You don't need much air pressure for a blast furnace only five feet high," said Thornton, as he pumped away at the first rabbit skin bellows completed.



New Wings for Your Voice

How improvements in telephony, telegraphy, radio and other mechanical methods of transmitting ideas are adding convenience and safety to modern life

By ROBERT E. MARTIN

"STAND BY!" Something is wrong in the submarine's whirling interior. Despite rapid fire orders and skilful maneuvers, the nose of the steel porpoise slowly settles, until it points straight to the depths, and only the tip of her tail remains above the waves.

Twenty-eight seamen, fighting for their lives, forge the first link of the chain of communication with the outer and upper world. A floating buoy is released, carrying an electric bell which rings loudly and continuously through the long hours of the day and the following night. At last a steamer is attracted by the soothing bell in mid-Atlantic, tapping on the hull reveals life within, and soon a hole is drilled through the steel, admitting a current of compressed air which clears the stifling interior of the under-sea boat.

Now urgent SOS signals spread through the ether, hour after hour. At last a schooner catches the call, relays it to the Naval station. Instantly the Navy springs into action—telephone and telegraph vibrates with orders. From the bridges of destroyers signals pass to engine rooms, human voices command and respond, communication is made through a telephone attached to the buoy, and a few hours later twenty-eight weak sailors of the depths emerge through a rough-burned hole to air, sunlight and life.

THIS actual experience of the U. S. submarine *S-1* is a striking example of how effectively modern technology has established communication between the minds of men. Today the waves of radio, sound, light and electricity teem with messages intelligible to the human senses, surge across the air, the sea and the land, linking continents together.

Today, by telephone, from virtually any state in the Union you may catch up any station in England, Scotland or Wales, and in one-fiftieth of a second your voice will be carried over 3,500 miles of land and sea to the listeners' home. Your photograph can be sent miles

through the air and at its destination almost perfectly reproduced. Pictures, drawings and written documents can be hurled across the Atlantic by means of radio or across the continent by telephone or telegraph wire.

And these wonders are only samples of what the future holds. In England, for example, only the other day, an image of a moving model was sent nine miles by radio, with reproduction clear enough to indicate eventual success of television.

Again beams of 'invisible light'—ultra violet rays which human eyes cannot see—were used recently as carrier waves for motion pictures in an unusual experiment performed by Dr. Donald C. Stockberger of the Massachusetts Institute of Technology. Thrown on a special screen, the pictures glowed with a pale greenish light. Over these same invisible rays music has been broadcast

and received with an ordinary radio set. They may be used eventually, Dr. Stockberger says, for glareless automobile headlights. The projected rays from apparently unlighted lamps would cause roads and fences painted with fluorescent substances to glow weirdly.

It seems almost incredible that such mastery of the secrets of vibration, bringing a new era of communication, should have been accomplished almost within our own lifetimes, especially when you consider that for thousands of years men have been endeavoring to develop better ways of transmitting their ideas to others. Nature began the process by placing in the human throat a sound-producing instrument, and in the human head two sound-receiving instruments. First man learned to vibrate at will the pair of muscular rindlike larynxes, producing a guttural noise. Then, with lips, nose,

throat and tongue, he learned to modulate the noise into sound vibrations representing meaning. These sounds, carried as waves through air or even

a solid substance such as wire or wood, impressed themselves on the ears of others, and through nerves and brain were converted into more or less equivalent ideas.

BUT man's struggle for existence soon required an extension of this mouth-to-ear communication of words and thoughts. He learned to relay the call to arms over hundreds of miles by deep-toned war drums. Centuries ago light waves were found useful for signals, by heliograph and beacon fires. The signal hills of the Romans, some of which were artificial, may still be seen to this day.

With the diffusion of knowledge that followed the invention of type printing came the demand for more



The "light organ" with which Dr. E. E. Fessenden and Dr. Norman Hilberry play tunes by directing light waves of various intensities on a photo-electric cell.



Dr. D. C. Stockberger of the Massachusetts Institute of Technology conducting his experiment in which music was conveyed on invisible rays and made audible by means of a radio set, by causing them to fall on a photo-electric cell substituted for detector.



War drums, beacon fires, post riders—all these were but a prelude to our modern marvels of communication—the latest of all, telephoning from America to England, in .018 of a second! The three photos show the main links in this artificial voice bridge. From the main control board at Rocky Point, L. I. center—the voice speeds across the ocean from the aerial right. At left, battery of powerful transmitting tubes.

rapid exchange of ideas. Within the last century communication has been revolutionized. It was only yesterday in history that post riders and Paul Revere carried messages over the countryside. It is only ninety years since Morse created the telegraph, and only sixty-nine since Cyrus W. Field tied two continents together with his cable under the Atlantic.

From the sending of signals by electric wires it was a short step to Bell's telephone. And then men conceived the idea that electric waves, as well as sound, could be sent across the air. The nineteenth century was just coming to an end when Marconi, from a liner sixty miles at sea, sent through the ether his famous code message. Two years later, wireless code signals spanned the Atlantic.

And now—latest marvel of all—with trans-Atlantic telephone you may converse with your friends across one seventh of the earth's circumference, although as yet there are a number of limitations. For one thing, such a

conversation will cost you at the rate of \$25 a minute! A recent twenty-eight-minute "gossip" between two women, one in New York, the other in London, cost them \$7.00, while in one six-minute call, a London business man held eight conferences with American associates for \$1.50.

MEANWHILE a thousand improvements in wired telephone and telegraph have made distant communication almost as simple a matter as face-to-face conversation. For instance when you send your voice over miles of wire, instead of becoming "tired" and weak on the journey, it is strengthened every mile or so by a tiny "loading coil," which revives the electric currents and sends them on their way with renewed energy. For long distance conversation, repeating stations every hundred miles or so serve as relays.

Moreover, five separate conversations now can be carried over a single circuit by means of high-frequency currents.

Even more amazing are the "mechanical brains" and electric fingers at the central exchanges, which receive your call and automatically connect you with one party out of tens of thousands.

One of our great railway systems, of 12,000 miles, now is operated entirely by the voice of the telephone. In large stations the stentorian voice of the announcer is replaced by loudspeakers. At a single tower in the Grand Central Terminal in New York, Bell and automatic telephones convey orders, the teleautograph transmits written schedules, loud speaking telephones, lamp signals, bell arm initiators, selector telephones and similar devices enable the public to travel safely, quickly and cheaply.

The telegraph, too, has grown far afield. With the new metal permalloy, one hundred times as responsive to magnetism as the softest iron and six times as fast in transmission, we save much of the metal formerly needed for cables. Our underwater electric spiderwebs today

(continued on page 158)

Hints for Radio Beginners

Do You Ever Forget Switches?

How to Simplify Your Current Control - Other Ideas

TURNING on and off the filament switch on your radio receiver is all that is necessary to put the set into operation and stop it again if it is run with a storage battery to light the filaments of the tubes and with dry cells to supply the B-battery current.

The introduction of trickle chargers and B-eliminators, however, has complicated the problem. Unless you buy an automatic relay switch to take care of turning on and off both the trickle charger and the B-eliminator, you will have at least three switches to throw every time you put the set into operation or stop it. And if you occasionally forget to turn on the trickle charger when you get through using the set, the A-battery will soon become discharged.

The diagram on this page will show you how to rig up a switch that will do all the necessary switching with one throw of the lever.

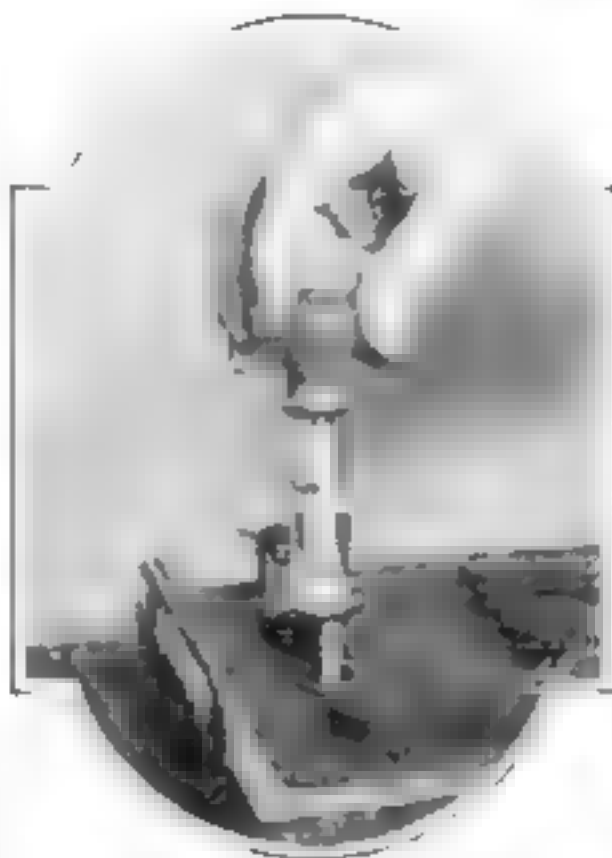
You will note that when this switch is thrown to the left, the filament current to the set is cut off and the connection to the B-eliminator also is broken, while the current is turned on to the trickle charger.

Even if you have to purchase the switch and sockets, the cost of this current control switch will be low. The switch and sockets can be mounted on the under side of the radio table.

Testing B-Eliminators

DON'T try to test the voltage developed by a B-battery eliminator with an ordinary type of voltmeter. It is impossible to get even approximately accurate results in this way, and you may fool yourself into believing that the detector and amplifier stages of your radio set are getting the proper voltages when the pressure actually may be far too high. The reason for this is that the voltage developed at any binding post on a B-eliminator of the conventional type depends on how much current is being drawn from the eliminator.

If you connect up a voltmeter to a B-eliminator while it is being used to operate a set, you will notice an immediate falling off in the volume. This will be due to the drop in voltage caused by the flow of current through the volt-



Test your battery occasionally to see if your trickle charger is keeping it in good condition.

Special meters suitable for testing the voltage of B-eliminators are available, but they are rather expensive. To adjust your B-eliminator, first make sure that you have the correct C-voltage.

Test Battery Frequently

THE popularity of the trickle charger, either as a separate piece of apparatus or as combined with a low capacity storage battery in the form of an A-power unit, has had an effect on the amount of testing that is needed to make sure that the storage battery is charged sufficiently. Instead of having to test the battery once every week or two, as is required when you charge the battery with a full rate charger, you need test the battery only often enough to make sure that the trickle charger is keeping the battery in a sufficiently charged condition.

It is desirable that the battery be tested every two or three days after it is first installed, and if you find, after several days or a week of use, that it is still fully charged, you can be sure that the current put in by the trickle charger more than balances the amount used up by the set.

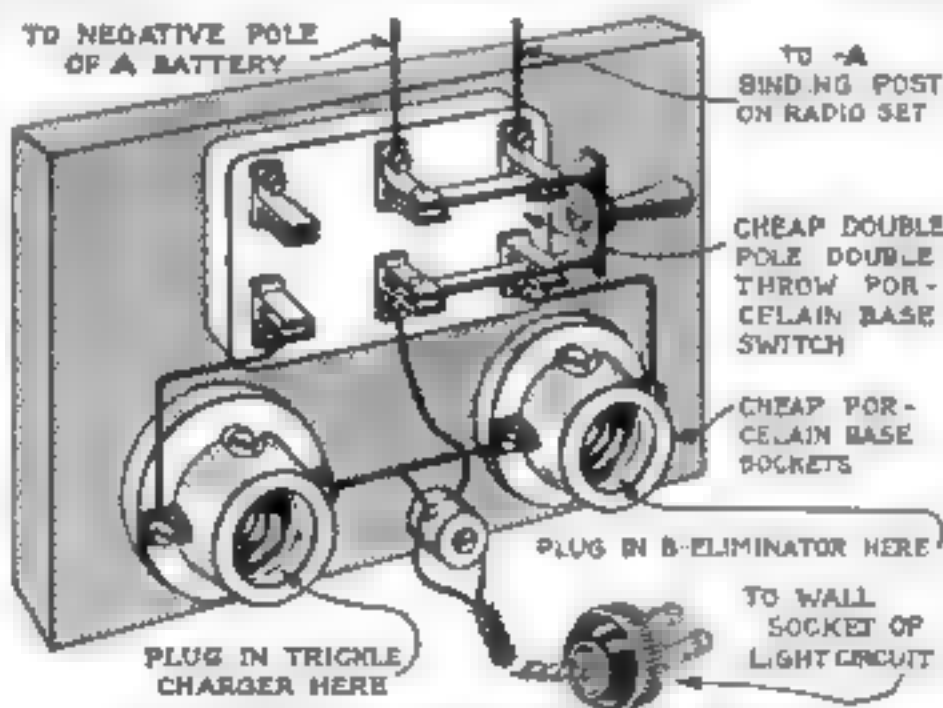
A floating ball type of hydrometer is excellent for such tests because it can be read so easily.

Grid Leak Affects Tone

NOW that the grid condensers used in most radio sets are so carefully made that there is practically no leakage of current directly through the condenser itself, radio fans are in a position to determine the effect, on both quality and volume, of changing the grid leak.

When you are using a tube of the 201A type, you will find that distant weak signals come in with greatest volume if you use a grid leak of very high resistance. From five to nine megohms is about right if you want to get the last mile of distance. On the other hand, a high resistance grid leak is not so good on powerful local signals. Distortion spoils the quality as soon as the volume approaches even a medium high level.

For best results on powerful local signals, use a grid leak of about one half megohm. The detector tube will stand a lot more volume without overloading.



A switch and socket arrangement like this will prevent forgetting to turn on or off the trickle charger and the B-eliminator.

meter. If, on the other hand, you attempt to test the B-eliminator voltage while the radio set is disconnected from the eliminator, the voltage will read too high.

A B C's of RADIO

THE old method of reducing volume of a radio set was to cut out the last stage of audio amplification, and consequently most old style sets were provided with jacks, so that you could plug the loudspeaker into either the first or second stage as required. The development of special power tubes for use in the last stage has changed all this, so that the best practice now is to keep all the

tubes in the audio amplifier end of the set working at all times and to control the strength of the signal before it is fed into the audio amplifier.

There are several ways of doing this, perhaps the simplest being a rheostat control of one or more of the radio-frequency amplifier tubes. Practically no loss in the quality of the signals received is noted when this type of control is used.

How Broadcasting is Improving

Better Transmission and Station Chains to Do Much for Programs

By

GEORGE LEE DOWD, JR.

Central ad apparatus at the studio was found. Note how the microphone has been placed in an awkward position.



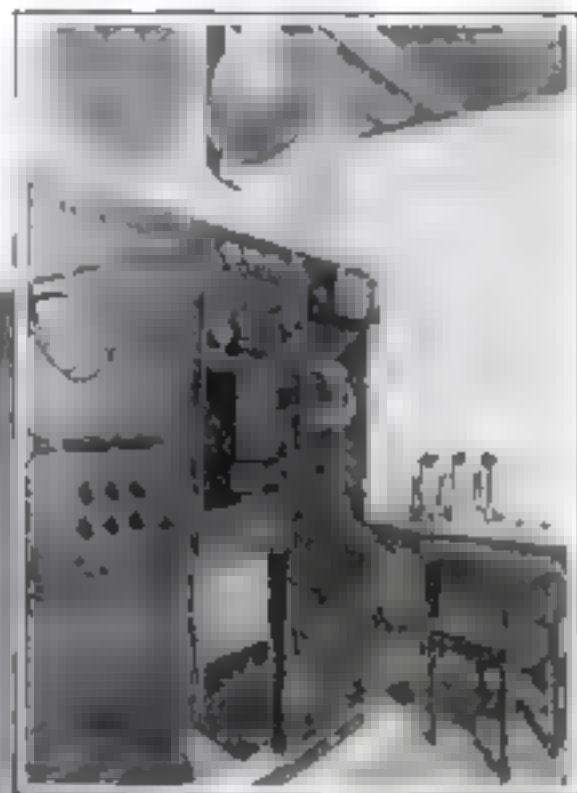
EVERYWHERE engineers, broadcast directors and others are working on plans to improve the quality of radio programs.

Perhaps some of the most important factors in the improvement of a radio set are the changes which have resulted in the improved quality of broadcast music. Also, the widespread public acceptance of radio and the intense competition between the various broadcasting stations have resulted in constantly improved programs.

Radio broadcasting has long since passed out of the experimental stage. Today the transmitting room of any large broadcasting station conveys a definite impression of solidity and permanence. The modern radio transmitter really is a specialized type of power house that transforms air vibrations into oscillating electric currents, amplifies them to an almost unbelievable extent, and then sends them out by way of the antenna to millions of listeners. And along with the increase in power and permanence of our broadcasting stations, there has been a vast improvement in the faithfulness with which the music and voices are put on the air.

This improvement in quality is most noticeable, perhaps, in the programs that are picked up by microphones at some distance from the broadcasting studio, largely because there has been more room for improvement in this type of broadcasting.

EARLY attempts to broadcast acts or scenes of musical comedy and opera productions direct from the stage produced weird results. If the tenor, for instance, happened to be near the microphone, his voice came through with a power that caused the loudspeaker to go off into a nerve-shattering rattle; while the voice of the soprano standing on the



Left: A modern radio studio. In the foreground, the microphone is placed in a position which is not ideal for the reproduction of the voice. The microphone is placed in a position which is not ideal for the reproduction of the voice.

other side of the stage resembled the feeble chirps of a canary.

What we may expect along these lines in the future was strikingly demonstrated recently when the chain of stations headed by WCAP and WJZ broadcast the famous "Garden Scene" from the opera "Faust" direct from the stage of a Chicago opera house. Listeners were

amazed at the fidelity of every part of the musical reproduction.

Fay Leone Faurole, general manager of station WABC, recently expressed the opinion that because of the improvement in the quality of the tones reproduced, the day of freak stunts in radio is over.

"In the early days of broadcasting," he said, "it was a job to fill our program. All sorts of novelties and freak stunts were put on to vary the monotony of a program made up largely of phonograph records.

"IN THOSE days, only a few years ago, nobody worried much about echoes or resonance, because the transmission was poor anyway. Then better microphones came into use. Modulation was vastly improved. In order to eliminate echoes and resonance, engineers fitted studios with so much sound absorbing drapery that the transmitted music was dead and lifeless, but I expect to see a considerable improvement along these lines in the future. We have found that a certain amount of resonance is desirable. It adds naturalness to the tone quality of the music or the human voice. In fact, our new studio was designed with that point in mind."

In large measure, the steady improvement in the quality of programs is due to the fact that advertising is footing the bill. And the broadcasting stations, in striving to get the business of the advertisers, have come to realize that listeners won't follow an evening's program, even with one or two high grade features sponsored



The oscillograph at WJZ, which permits the engineer in charge to study the modulation and gives visible evidence of incorrect adjustment.

by advertisers, if the rest of the program isn't worth listening to.

"We have been practically forced," said the manager of a prominent Eastern station, "to contract for high grade features that we pay for ourselves so that our advertisers will feel that they are in good company."

OTHER stations accomplish the same result by employing as staff artists, entertainers of such exceptional ability that the studio staff is capable of putting on a program equaling the special features in quality.

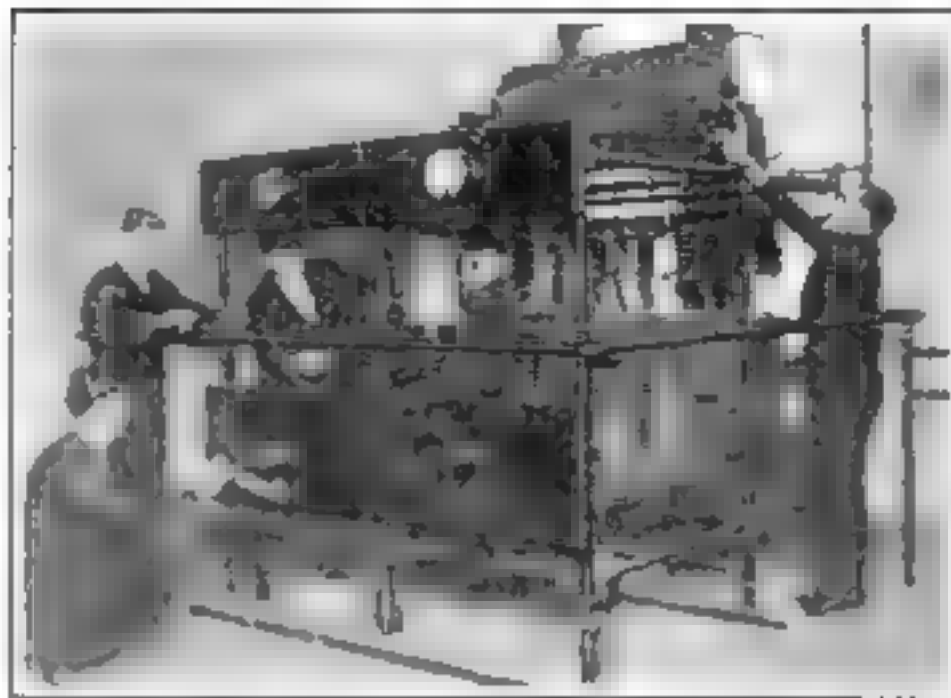
You and I and the rest of the millions of radio broadcast listeners get the benefit of all this dazzling array of talent without a cent of expense. Many readers of *POPULAR SCIENCE MONTHLY*, however, have expressed a fear that the rapid development of the chain station idea—whereby the actual performance before the microphone is sent out by wire lines to many other stations so that all the stations transmit the same program simultaneously—will not work out well for several reasons.

"Suppose we don't happen to like the particular program the chain stations are broadcasting, what then?" writes one reader. There would be cause for worry on this subject if the Government controlled broadcasting and if the programs were paid for out of license fees extracted from the listeners, as is the system in many foreign countries.

But such a situation will not arise in this country, for reasons that appear at once when you study the requirements of the advertisers who pay for the programs. An advertiser who sells his products all over the country naturally wants to build up good will by means of a chain of stations that will reach as many people as possible. But there are other advertisers who want to reach just one section.

THE big chains of stations, headed by WEAF and WJZ, will take care of the first group, while stations like WABC in New York and similar stations in other localities will supply the demand for broadcasting in a specified area.

Improvement is also promised in the broadcasting of all special features not considered part of the regular program. Verbal reports of sporting events, for example, will be much clearer owing to improved methods of picking up such features and transmitting them to the main broadcasting studio.

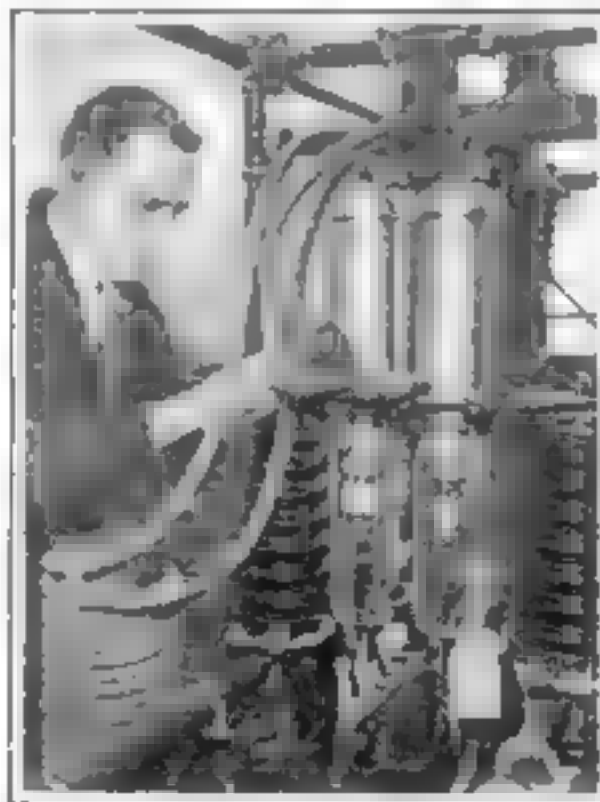


This modern, high power transmitter in one of our large broadcasting stations, gives an impression of solidity and permanence.



Development of simultaneous broadcasting by a chain of stations assures good programs to everyone. The chain headed by WJZ is represented by stars that headed by WEAF by dotted circles. Ultimately every section of the country will be served by these chains.

Early attempts at broadcasting prize fights or football games, for instance, were marred by the shouts of the fans surround-



Present-day stations are really special purpose power houses. Batteries of vacuum tubes supply the radio-frequency energy.

ing the announcer to such an extent that his words were lost completely at vital moments. In future, we are promised, the applause and shouting will be present as a background for the announcer's voice, but will not be allowed to interfere with the clarity of his words.

The development of the chains of stations will certainly help the broadcasting of outstanding events such as a speech by the President of the United States, because with so many stations transmitting the speech you will be sure to get it clearly from at least one station.

As far as exceptional features are concerned, prominent advertisers are combing the country for high priced opera stars, great musicians and other entertainers, and promise steady improvement in the quality of their offerings.

MUCH has been said and written about short wave transmission and its possible effect on broadcasting and the sets now in use. I talked this matter over with Alfred H. Grebe, who has experimented extensively with this type of broadcasting.

"I don't think there is a chance that broadcasting will in the near future be changed

to the short waves," he said. "At least not until some apparently insurmountable difficulties are worked out. In the first place, none of the millions of radio sets in use today can tune in the very short waves; in the second place, short wave transmission has at least one peculiarity that renders it unfit to use for regular broadcasting.

"RADIO waves of from twenty to forty meters' wave length carry marvelous distances, but they seem to pass over a large section of the country immediately surrounding the transmitter, so that listeners only a few miles away may not hear anything, while other listeners hundreds or even thousands of miles away may hear the program with great volume. There wouldn't be much use in transmission like that except for special purposes.

"Of course we expect to continue to use our mobile stations transmitting on waves lower than the regular broadcasting range, to bring special features into the studio whenever it is not possible to get a regular wire connection. For instance, a description of a yacht race by an observer located within a stone's throw of the boats is made possible in this way."



With 700 radio stations now on the air, with wave lengths available for only a fraction of that number, Uncle Sam is just waking up.

Don't Blame Your Radio Set!

Why You Get Several Stations at Once

By ALFRED P. LANE

IN THE last few months hundreds of readers have written to POPULAR SCIENCE MONTHLY complaining about the poor results they are getting from their radio sets, and asking for suggestions to help them improve their reception. They want to know, in particular, what causes the terrific whistling noises that they hear and why they are unable to separate the different stations.

A letter from a reader in Chicago is typical. He writes:

"I wish you would tell me what is the matter with my radio set. Last winter I got fine reception. I could hear a large number of distant stations on any good night, and when the static was light I got them as clear as a bell. But something must have happened to my set, because this year I find it almost impossible to get any distant stations without a most unpleasant whistling noise. The whistle wavers slightly in tone but keeps up no matter what I do in the way of changing tubes, buying fresh batteries and looking over connections.

Lately the whistling noise has started on some of the powerful local stations and in some cases it is so bad that it spoils the music. Besides this trouble, my set doesn't seem to be selective any more. Two and sometimes three stations come in all jumbled up together like boarding house hash. Please tell me what to do about it.

It is a hundred to one shot that nothing is wrong with his set. Probably it is just as good as it ever was. The trouble is that there are far too many broadcast stations on the air.

PRESIDENT COOLIDGE, in his annual message to Congress, summed up the situation in a nutshell. He stated: "Due to the decisions of the courts, the authority of the Department of Commerce under the law of 1912 has broken down, many more stations have been operating than can be accommodated within the limited number of wave lengths available; further stations are in course of construction; many stations have departed from the scheme of allocation

now set down by the Department, and the whole service of this most important public function has drifted into such chaos as seems likely, if not remedied, to destroy its great value. I most urgently recommend that this legislation should be speedily enacted."

Meanwhile radio broadcasting is going from bad to worse, and will continue to do so until some definite action is taken. When the President spoke, there were slightly more than 600 stations on the air. As this is written the number has increased to about 700. Each new station means just so much more squealing and howling and interference for thousands of radio fans.

The reason for the long delay from the legislative standpoint has been: To whom should the control of radio broadcasting be awarded?

ONE group has held that radio should be under the jurisdiction of the Secretary of Commerce. Its opponents have contended that a commission form of control is preferable. This has been the chief obstacle to the clarifying of the radio situation, in spite of the fact that there are other knotty problems which must be solved either now or in the near future if broadcasting is to be permitted to develop along lines that will bring the greatest amount of pleasure to the largest number of radio listeners.

Listening in for just one evening will prove to anyone that there are too many stations on the air. But what is to be done about it? Who is to say that this station is necessary and that one superfluous? How are the unneeded stations to be denied the privileges of the air? Answering these questions will require much hard thinking on the part of our legislators, especially since

radio broadcasting offers legal problems for which there are no precedents.

But after all, what you as a radio listener want to see is the air cleaned up so that you can sit down before your radio set in the evening and get clear music and speech from several different stations without having your radio entertainment ruined by howling interference.

Unfortunately, there is nothing that you can do to your radio equipment that will help in the slightest degree to overcome the troubles brought on by too much broadcasting. Even a laboratory model receiver built by the most skillful radio engineer could not unscramble the stations from the mess of heterodyne interference that is daily becoming worse.

As we go to (Continued on page 127)



With too many stations on the air at once, this is what happens to most of us. What remedy will be applied?

I Catch *My* Wild

By

Wynant Davis Hubbard

For several years Wynant Davis Hubbard, a former Harvard football player, hunted wild animals in Africa, not to kill them, but to capture them alive, train them, and ship them to American zoos. His amazing experiences, some of which he relates here, are stranger than romance more exciting than heart-thumping. The ordinary African game hunting expedition seems tame compared with the adventures of this larval thresher of the jungles.

But I wasn't particularly confident. In several years of adventure over more than five thousand miles of South Central Africa I had hunted and captured plenty of big game alive, but never before had I tackled a snake the size of this one. Naturally I was somewhat doubtful how to go about it. I had heard of men noosing pythons, but such a method seemed unnecessarily dangerous. For I knew that while a python can inflict a severe bite, its most deadly weapon is its tail. With this it can strike a blow that will snap a man's legs as if they were matchsticks. Thus, while noosing the snake's head unduly would prevent its escape, it would also leave fifteen to thirty feet of writhing muscle lashing around furiously at the end of the rope.

"We've got to get it by the tail," I thought. And immediately a plan suggested itself. Why not use forked sticks, the most reliable cat-carrying implements any hunter can have? Quickly my int've boys cut four heavy sticks about five feet long and deeply forked at one end; also a long light pole with which to poke the snake. Then I outlined the plan of attack.

"MANGINERA, Kaputang and Towl, I said, "each of you take one stick—give me one, too. Now, I will push the snake with the pole and try to make it straighten out and move away. If it does, we four will approach quietly, and when I shout we will pin the snake down with the forked sticks. I will take the tail. Manginera, you take the head. Kaputang and Towl will be between. Do you understand?"

"Yes, Inkos," they answered.

"THERE Inkos, in that bush! See, it is looking at you. A big one!"

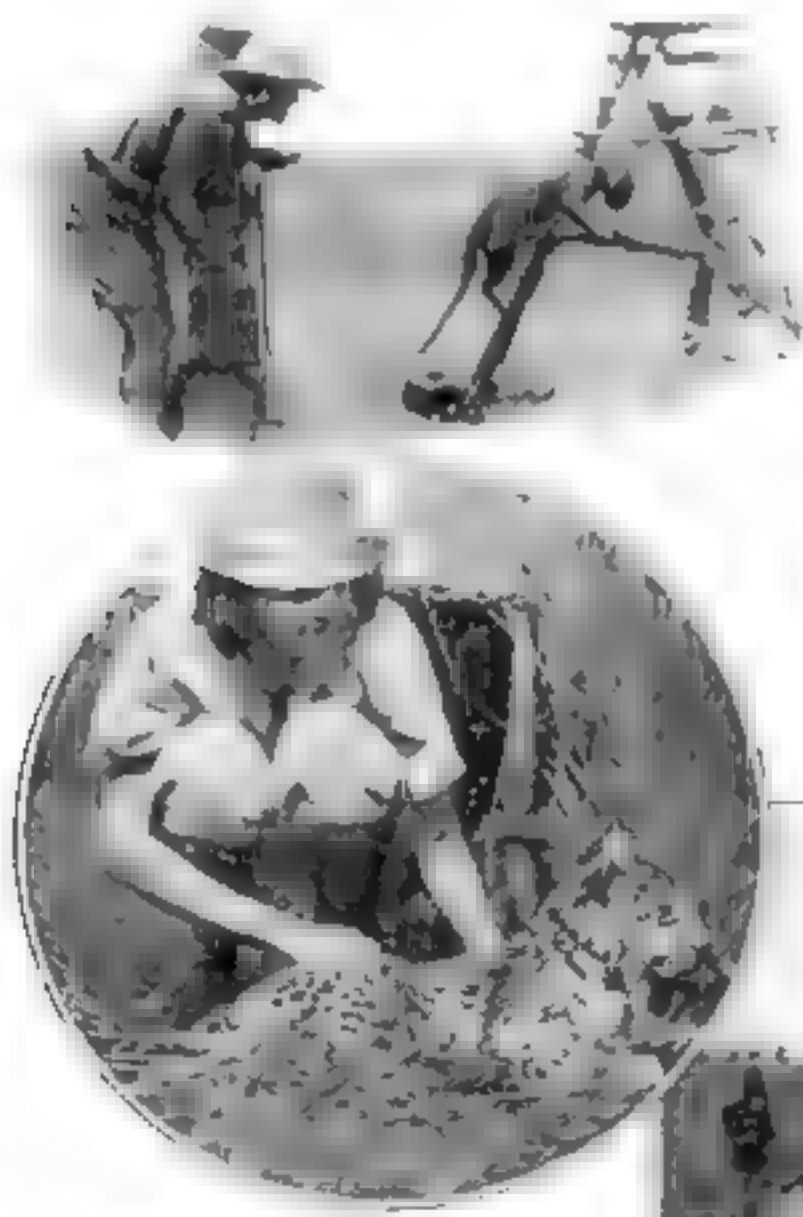
Longone, one of my native black boys, pointed excitedly to a clump of evergreen bushes. For a moment I could distinguish nothing, then suddenly the green shadow I was looking at took on the hideous shape of a huge python! Its supple body, coiled menacingly, looked as big around as a man's thigh. Close by lay an oribi antelope which the python had just killed, probably by one tremendous square and a bite on the head. Apparently we had interrupted the slayer's meal.

I turned to Manginera, my faithful pigmy gun bearer and adviser.

"Manginera," I said, "we certainly can't catch this snake when it is coiled up like that. Do you think we'll have a chance if we trace it and make it stretch out?"

"Maybe, Inkos," he said.

Sable antelope calf caught young, shown with Mrs. Hubbard. Trusting and friendly these animals are very easy to raise. Full-grown, they have horns measuring fifty inches, with which, lying down, they defend themselves from attack.



If a full-grown leopard got loose and climbed, snarling and growling on top of the monkey cage how would you catch him? Mr. and Mrs. Hubbard took hold of his tail—but it was a perilous ten minutes before they managed to slip his collar on! Bosco, a half-grown leopard, is shown here putting contentment under Mrs. Hubbard's caresses.

Center above: Skillum, the leopard used as a family pet, being sprayed to rid him of fleas.



In this picture, showing Mr. and Mrs. Hubbard and their two children, the explorer is riding Yank, the six-year-old elephant whose thrilling chase and capture by the tail are described in the article.

Beasts by the Tail!

Some Glorious Free-for-Alls I Have Had in the Jungle with Man-Crushing Pythons, Elephants and Wild Boars

"But be careful," I cautioned, "Don't touch the snake until I say the word. You other boys," I said, turning to the rest of my helpers, "stay close in case something happens."

Approaching within four feet of the coiled mass, quietly so as not to alarm it, I poked it gently with the long pole. If it had lunged at me, I would have had to run. But luck was with us, for the big brute slowly uncoiled and straightened out as it prepared obligingly to crawl away!

"Come on, Mangineera. Gently now. Watch its head boy!" I was almost whispering my directions. All three boys were walking stealthily alongside the slowly moving creature.

I got up close to the tail. I could see the entire shimmering length.

"Now!" I shouted.

Down came the four sticks together. The boys grunted as they put their weights to the poles. I pushed with all my strength. The great snake hunched up in bunches between the sticks, trying to free itself.

I CALLED to the other natives, who had been watching open-mouthed. They rushed up and we had eight more clutching the slippery body. Mangineera slid his hand down and found a bold just cork of the flat head.

"All right, now," I ordered, "pick it up."

The python must have weighed a hundred pounds. It writhed and buckled. I could feel the powerful back muscles flow under my grip. But finally we managed to stuff it into a huge sack that

one of the boys had brought. Then we tied the bag to a pole and carried our prize back to my main animal catching camp at Tara, Northern Rhodesia. There we took it out and measured it. It was exactly seventeen feet, five inches long!

THIS struggle was typical of countless exciting adventures and narrow escapes which fall to the lot of the professional animal catcher. Catching dangerous animals alive is the most thrilling sport in the world. In my opinion it far outclasses hunting to kill; for it is a game in which human wits and strength are pitted against the power and cunning of wild beasts, with the chances of victory on a fairly even basis.

By odd coincidence, the only other python I ever was fortunate enough to capture was found within a week of the first. This time, however, the battle nearly ended disastrously for me. Apparently the snake had just finished its dinner, for about a third down its length was a bulge the size of an antelope. That the victim had been a ram was evidenced by the horns, which projected until they almost punctured the snake's skin.

Again we came down with our forked sticks; but this time I was caught off my guard. Instead of keeping my eyes on the dangerous tail, my attention was

Continued on page 129.



Wynant D. Hubbard with his family watchdogs Skillum, the leopard, and Bandy, the Great Dane, who became great friends and ate out of the same bowl.



The family cat—a white-tailed mongoose, kept in the Hubbard kitchen after its capture to catch rats and mice, which it does with remarkable success owing to its extraordinarily sharp eyes, agility and lightning speed.

Center, above: A wart hog, so-called because of warty excrescences on its face, trussed and tied after its capture ready to be toted to camp.



This is the wart hog whose thrilling capture, after an all-day chase under a broiling tropical sun, is described in the article, being carried back to camp. Hubbard caught him, finally, by the leg!



That teeth furnish starting point of man's development is shown in the photograph of Dr. R. B. Harvey, New York, who is studying the evolution of the teeth of man and the teeth of the various animals.

On the picture you see a man with a toothy grin. He is Dr. R. B. Harvey, New York, who is studying the evolution of the teeth of man and the teeth of the various animals.

Food Crops Increased by Science

IMPORTANT new ways of developing a larger and better food crop have come to light through recent scientific experiments. For example, Prof. R. B. Harvey of the University Farm, St. Paul, Minn., reports that he has speeded up the ripening of fruits by subjecting them to gas attacks with two ingredients of common city gas, ethylene and propylene. In his experiments, he says, bananas and honeydew melons were found to be especially benefited by the gas treatment.

Other tests by Dr. M. Jacobson, plant physiologist of Camden, N. J., indicate that seeds subjected to mild doses of so-called "soft" X-rays produce greatly increased yields. Potted plants from rayed seeds flowered and bore fruit from one to three weeks earlier than those from unrayed seeds, he reports, and their yield was from fifteen to 170 percent greater. Potatoes from treated tubers gave crop increases of 170 percent.

Scientific breeding of wheat, like the raising of pedigreed livestock, also is proving of great value. According to Dr. R. J. Garber of West Virginia University, farmers in the great wheat belt of Canada alone have obtained eighty million more bushels a year since planting an improved variety of wheat.

Guncotton from Garbage

POSSIBLY some day nothing whatever will be wasted. The last word in salvaging scraps comes from Berlin, Germany, where an engineer, Kurt Gerson, has recently erected a large plant to convert the garbage of the city into guncotton, artificial silk, and other useful products.

By his process, all cellulose matter is sifted from the garbage and subjected to special treatment. Moreover, by dis-

ting such matter as potato parings and pieces of wood, Gerson declares he can produce tar, charcoal, and acetic acid.

Voice Secrets Revealed by Camera

THROUGH the magic of photography, experimenters are revealing in black and white new secrets of our voices, and their effects upon listeners. Recently Dr. Carl E. Seashore of the University of Iowa, demonstrating how he makes sound waves appear before him, produced a visible record of a negro blues song. He showed that the black and white impression of the sound waves was far more reliable than trained human ears in re-

cording pitch and timbre of the voice.

From sound photographs, Dr. Seashore and others are studying the factors that make singing beautiful and appealing. For example, they have discovered that the quivering vibrato is an important means of portraying emotion in music and speech.

Prof. G. Oscar Russell of Ohio State University recently succeeded for the first time in making photographs of the interior mechanism of the voice. This he achieved with a camera connected with a tube containing mirrors, lenses, prisms and a lighting device.

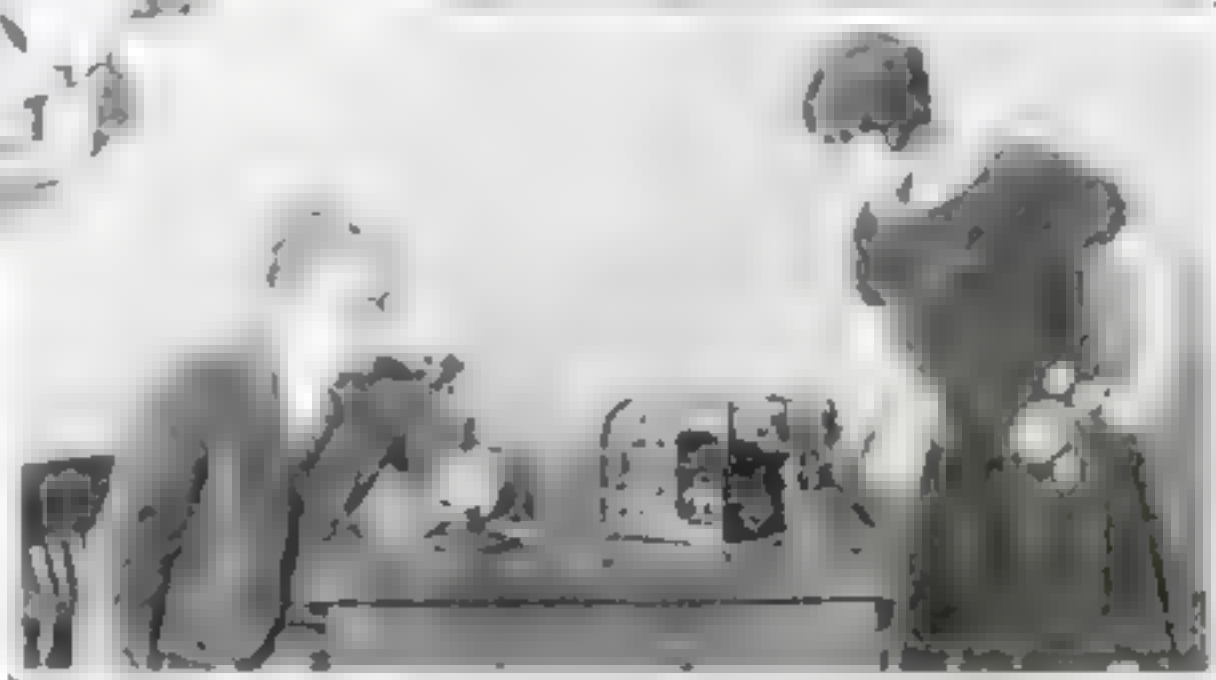
Now—the Pedigreed Oyster

AFTER many remarkable experiments, William F. Wells, biologist of the New York State Conservation Commission, has succeeded in raising a superior breed of oysters.

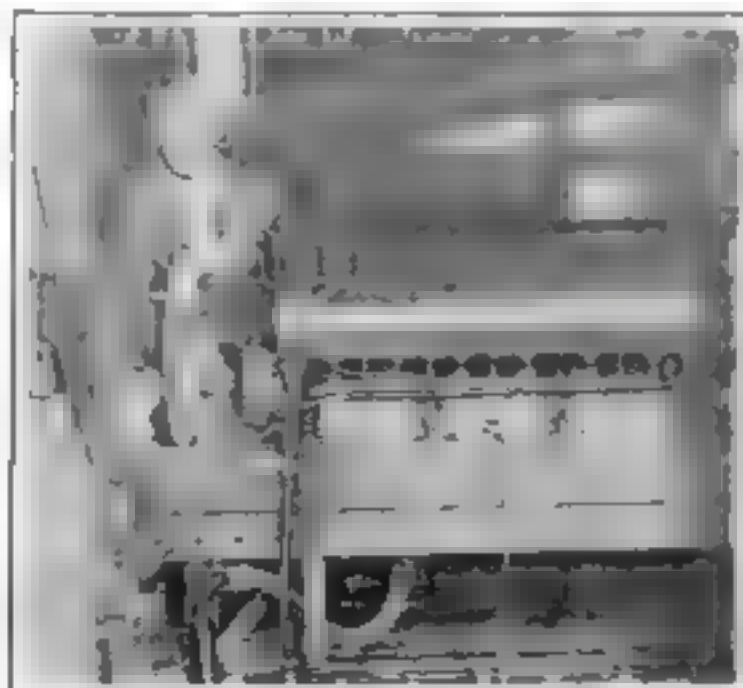
The super-oyster is said to be fatter, more tasty, faster-growing and harder. It lives in a shell of improved design, decorated with a symmetrical pattern, and far different from the clumsy, misshapen home of the ordinary oyster. It is the result of modern scientific breeding methods, such as have produced the paper-shelled perna, the seedless orange and countless other improved foods.

He Draws Electricity from Light

ANOTHER step toward realization of the fascinating dream of obtaining power from the sun is seen in the recent success of Dr. W. W. Coblentz of the U. S. Bureau of Standards, Washington, in generating electricity from light through the agency of the mineral molyb-



Sounds can be "seen" and the deaf can "hear," by means of the "phonoscope," the invention of Joseph W. Legg, New York engineer. The device registers the vibration of the voice by a beam of light and a small revolving mirror. In the picture Mr. Legg is speaking into the device while Mrs. E. S. McKay reads the "patterns" made by the vibrations.



One of the first tests made in the new altitude chamber of the Bureau of Standards, Washington, was that of the latest Curtiss 375 h.p. airplane motor, equipped with a supercharger for high altitudes. E. W. Hen is shown making final adjustments on the recording apparatus.

with Science

denite. This mineral is one of the chief sources of molybdenum, used in steel making.

Dr. Kohlenta discovered that a crystal of molybdenite, when exposed to natural light, produces an electric current; in fact, he was able to obtain in this way two ten-thousandths of an ampere of current. Moreover, by using vacuum tube amplifiers, such as are employed in radio, the feeble current may be magnified greatly, making the crystal available as a delicate light detector, or electrical "eye," such as the photo-electric cell.

Old Silk Made into New

WORD comes from Japan that old silk stockings and worn-out silk clothes need no longer be thrown away, but can be turned into new silk of better quality than the original. A few weeks ago Dr. P. P. von Wernich of the Imperial Research Institute at Chuka completed experiments in which he claims to have made waste into threads of higher quality.

The old silk rags were dissolved, then put through chemical processes which converted them in turn to a liquid, a jelly, and finally to a plastic substance that could be drawn out into threads.

Circles Earth in Sub for Science

MEASUREMENTS which may prove invaluable to science in studying earthquakes and the earth's structure are being computed by Dr. Vening Meines, young Dutch scientist, as the result of a remarkable underwater voyage which he recently made around the world in a submarine to measure variations in the force of gravity at different parts of the earth's crust.

At some points on the earth's surface objects weigh slightly more than at others. These differences, while too small to be detected by ordinary scales, are important to scientists as indicating differences in the density of rocks in the earth's crust. It was because the motion of a surface ship disturbs the apparatus for measuring such variations that Dr. Meines carried the apparatus undersea around the world.

Light Rays Source of Life?

IN THE mysterious and highly penetrating cosmic rays which bombard our earth from outer space and which reach us with power to pierce six feet of lead, science may find the source of all life energy. Such, at least, was the fascinating possibility suggested recently by Dr. Michael L. Pupin, physicist, of Columbia University.

"The source of life energy is at present

A discovery new to the world has been made by Dr. William S. ... of the University of Pennsylvania ... he remarks ... must ... the electricity of the human ...



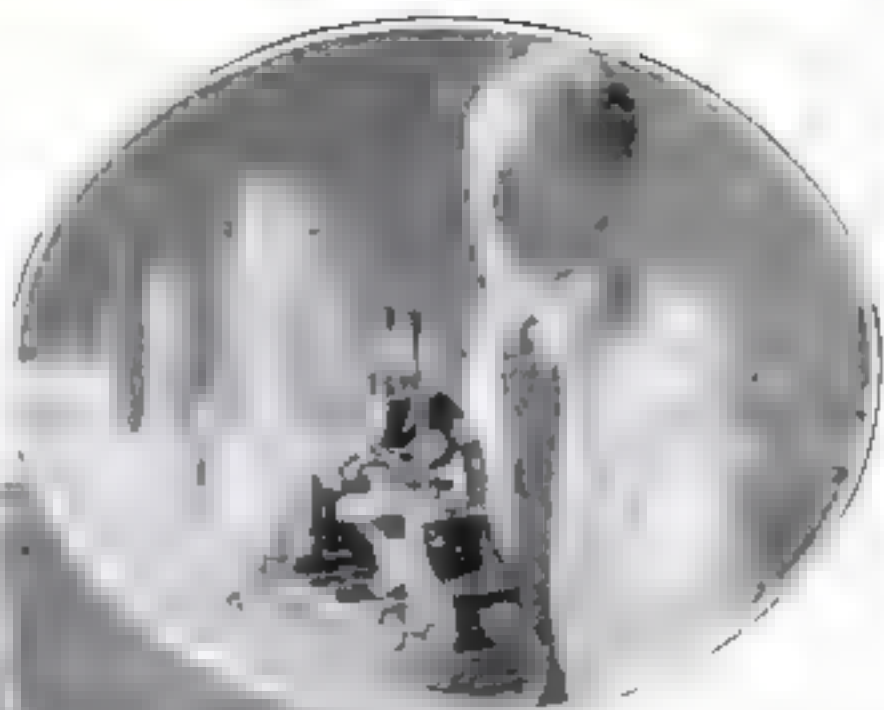
How hard and high does your auto bump? To find out, and to test shock absorbers and snubbers, Professor Fox of the University of Iowa has devised an artificial set of bumps, produced by a continuous treadmill with uneven surface. In the illustration the professor is watching the results traced in jagged curves on a special seismographlike instrument.

unknown," said Dr. Pupin explaining his new theory. "We know that all chemical action is accompanied by ionization. We know that these rays—the so-called 'Millikan rays'—strongly cause ionization. My suggestion is that the ionizing power of these rays furnishes the energy of the living cells."

The cosmic rays are many times as penetrating as the most powerful X-rays and radium rays. Scientists believe they



Whether the steel framework of a burning building would collapse under the heat is determined by this device at the Bureau of Standards, Washington. Photo shows P. D. Seitz reading the amount the gages yield, subject to high temperature and pressure.



come from the sun and other stars, and that their energy is released when electrical particles, or electrons, combine to form atoms of matter, or stars, under terrific pressure. Its energy is sent flying through space with the tremendous speed of light.

If Professor Pupin's theory is correct, it is possible that tremendous transformations which took place in stars in the far-distant past, millions of years ago, may today be supplying the energy to every living cell in the animal and vegetable worlds.

Now Airplanes Excel Insects

SO RAPID has been the progress in airplane design that today man excels most of Nature's flying creatures in keeping himself aloft with wings. This conclusion is based on recent remarkable measurements made in France by M. P. Portier and M. de Rorthaya. For comparison with the lifting capacity of airplane wings, they measured the wing areas of different insects, and determined the weights supported by these areas.

Modern airplanes support weights of from two to four pounds on each square foot of their wing surfaces, some even more. In contrast, the wings of a variety of carpenter bee, record holder in this respect among insects, were found to support a weight equivalent to only six tenths of a pound per square foot.

Many butterflies and other insects with large wings made even poorer showings. Some of them were able to support the equivalent of only a twentieth of a pound per square foot of wing surface.

Serum for Rheumatism

"THE most important advance in medicine since insulin" is the way many physicians had preliminary announcement of a serum treatment for acute rheumatic fever, commonly known as rheumatism. Credit for the isolation of the organism of this baffling disease and development of the antitoxin, if confirmed by further tests, will go to Dr. James C. Small, chief bacteriologist of the Philadelphia General Hospital, and his staff

The First Beauty Parlor

Our ancestors cut their hair with clamshells—Some strange ancient inventions—How much your dog can understand—Facts about cyclones—Fascinating books

By THOMAS M. JOHNSON

"A Bird's-Eye View of Invention"

By A. Frederick Collins
Thomas B. Crowell Company

DID you know that the first beauty parlor was equipped with a pair of clamshells? Or, if it was run by "Madame" Somebody, with a complete outfit of sharks' teeth? Perhaps a sharp edged flat stone stood in the corner.

That was all that was needed in those primitive times, but with such tools our ancestors gave themselves the first haircuts. Then they went down to the tailor shop to try on their new suits of bark fiber which the tailor had been beating with the rounded end of a club, on a smooth stone under water.

From that day to this, man has been inventing things, always doing something a bit better than before, or doing something nobody else had done before.

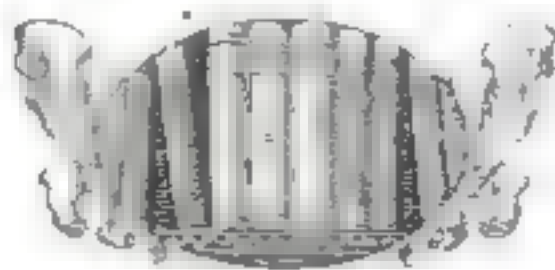
This book, "A Bird's-Eye View of Invention," abounds in statements of simple but amazing facts. For example, the following:

"That prehistoric man made measurements long before he had learned how to count, there is not the slightest doubt, and that he knew how to count long before he had invented figures, is a moral certainty."

Our three most indispensable tools, the hammer, the knife and the saw, were the first to be invented. After man had learned to saw with the jawbone of a snake or harkbone of a fish, he set a fishbone in a stick and rotated it between his palms, and behold, he had a drill! Then he split a green stick at one end, and had a vise.

MUCH later, man found metals and how to use them. Long before Christ furnaces were built upon hilltops where the wind could fan them. Then came artificial wind, the first blower, a goatskin sewed up and fitted with valve and nozzle. Steel tools have been found in pyramids dating to 2,500 years before Christ.

The original farmer loosened the soil with a stick, which was the



original hoe and until the eighteenth century farm tools were very primitive. For a long time a plow was simply a crooked branch with a pointed fork. The first iron plow, patented in 1787, was a "boy" because the farmers thought it poisoned the soil! Until 1839 the harrow had not changed much from the Middle Ages. There was a great flood of useful farm inventions about this time—reapers, grain drills, binders and threshers. Considering the changes of the last fifteen years, it seems almost incredible that the gasoline tractor did not really "come in" until 1903.

"Power" was ushered into man's affairs by the treadwheel, invented long before the written history begins. It was made by fixing to a shaft paddles which a

man then stepped upon. A Saracen invented the windmill, and the Crusaders brought it to Europe in the twelfth century.

The first wheeled vehicle, a rough cart, was first drawn by man, its inventor, and later by a bullock. Its broad engines and cars did not come until 1769 and did not really work until 1804. The first American-built locomotive, the "Best Friend," burst upon public gaze in 1831 and later burst in small pieces, but was soon followed by others that did not.

RAILROADING has been one invention after another. In the first block system, for instance, the engineer passed a staff from one station agent to the next, much as relay racers do. Until the staff was in the station agent's hands, no train could pass into the same block, in the opposite direction.

Did you know that the first telegraph had twenty-six wires—one for each letter in the alphabet—and that the forerunner of the telephone was the old familiar "lovers' telephone" made by connecting with a taut string two cylinders, perhaps even tin cans? From such beginnings came "the most valuable single patent ever issued," given to Bell in 1876.

The author was himself an early experimenter in radio, and his chapters discussing wireless communication, including television, are among the most interesting in the book.

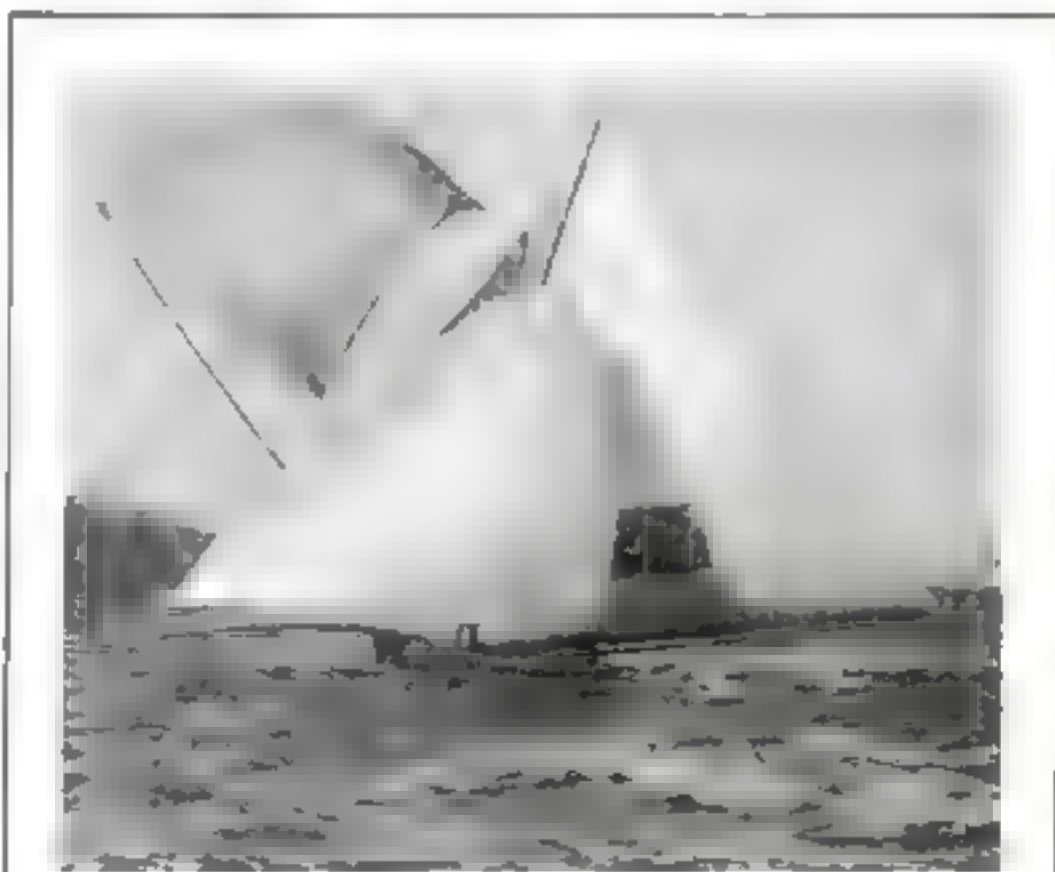
"Tropical Cyclones"

By Louis M. Chino
The Macmillan Company

THIS book may help to prevent or at least to reduce the damage done by tropical cyclones, which the author has studied for thirty-seven years along the coast of the Gulf of Mexico. The result is that he has some ideas of his own that differ from those held by many.

He believes he has found how better to foretell the course of a cyclone, through the discovery that the air current in which the cyclone travels materially influ-

(Continued on page 143)



Trapping the Breeze Under Full Sail

SCUDDING before the wind, its huge spread of canvas bulging like an umbrella, this unusual little sailboat astonished spectators at a recent yacht race in Sydney Harbor, Australia. Although little larger than a catboat, it carries, beside a mainsail, a balloon jib and a flying spinnaker. The latter is set on the side opposite the mainsail by means of a long spinnaker boom. Sand is used as ballast.

INGENIOUS INVENTIONS



Huge Desert Ship to Speed over Sand on Wheels

AN OCEAN liner on land is the monster vehicle proposed by a German inventor and pictured in our artist's conception above. J. C. Bischoff, of Kiel, the designer, sees desert travelers of the future embarking on a land slip that surrounds its 300-odd passengers with all the luxurious comfort of a modern sea liner. Within its windowed cabins the traveler would have no fear of hunger, thirst, nor the once-dreaded sandstorm. Gigantic gasoline motors in the hull

would turn the forty-foot wheels, which are rimmed with paddle-like blades to gain a firm foothold in the shifting sands. At the front of the 300-foot craft are the pilot house and steering apparatus, and from a near-by bridge the captain issues orders. At night a powerful searchlight would cast its beam over the sands through which the ship plows at twenty miles an hour in an airline to its destination.



Will the camel give way to this luxurious desert ship on wheels?



A Boat That Couldn't Sink—It Bails Itself

IN THE belief that he has perfected a system that would make boats unsinkable, Fred N. Nelson, of Seattle, Wash., plans to demonstrate the model craft above before Navy officials. A unique self-bailer designed to eject water automatically from the hold, and a safety ventilator near the stern which admits air

but not water, are features of his plan. In the illustration, the inventor is about to test his device by placing the model, weighted down with bricks, in a tub to see if it will float.

Lifeboats equipped with this self-bailing system would be unsinkable under the worst storm conditions, says Nelson.

Navy Tests Oil Burner for Planes

AIRPLANES were run successfully on a heavy oil instead of gasoline in recent tests, and special Diesel engines, burning this inexpensive fuel, may soon be installed in Navy planes, according to Dr. Joseph B. Ames of the National Advisory Committee for Aeronautics.

Two Feet Wide—a Real Auto!

PRETTY nearly the ultimate limit in small size for an automobile that can carry a man-sized passenger, the car below was built by Isidore Lubin, New York City mechanic. A little more than two feet wide, it threads its way easily through a maze of traffic that hopelessly ties up ordinary vehicles.

The little auto is surprisingly speedy, keeping pace with most large cars.



A mere slice of an auto, this—but on New York's crowded streets it has its advantages



Leaving rubber paving on a London street. At right, blocks with mounting rollers being

London to Have Rubber Street

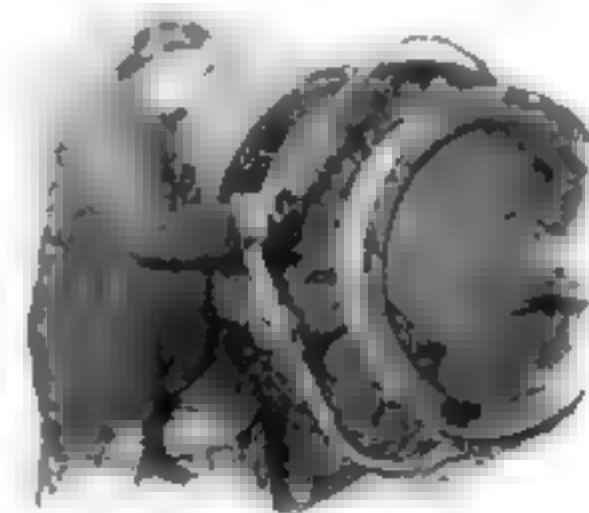
WHY not streets of rubber, as well as rubber automobile tires? So reasoned a Manchester, England, manufacturer at whose cost New Bridge Street, London, is being paved with rubber blocks. The heavy traffic on this street, he expects, will give a conclusive test of his claims that rubber paving will reduce dust, noise and the danger of skidding, at the same time proving as durable as conventional paving materials.

As used in this unusual construction job, the new blocks, one of which is illustrated, are made of terra cotta with a rubber facing. They are laid and cemented together like ordinary blocks, as shown in the photograph above.

This Automobile Horn "Talks"!

"PARDON me, but would you mind stepping out of my way?" is said to be the warning shouted by the newest auto horn, which addresses careless pedestrians through a phonograph loud-speaker. Admonished in such a manner, the astonished pedestrian could hardly fail to heed the automobilist's courteous injunction.

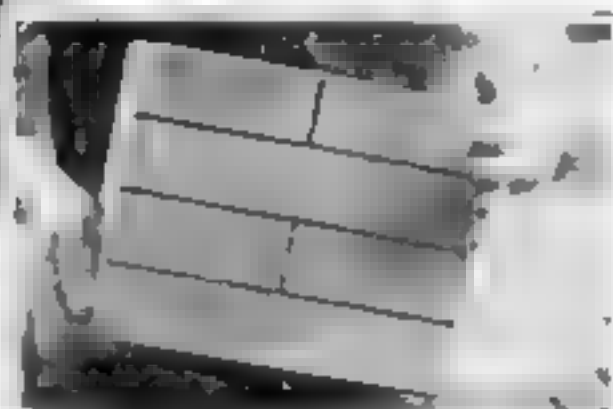
According to the new horn's inventor, Benjamin Freeble of Detroit, Mich., the same device could be used as a railroad crossing guard to announce, "Trains coming on the east track!" or "All clear. You may proceed."



Some Callipers!

HAVE you ever wondered what they measure car wheels with? Here's how it's done in that big Pacific Rimmed's shops—and you would work these callipers with one hand, please. In this picture they're helping to set up a pair of car wheels that are being turned in a special lathe.

Of course callipers are rated by the diameter of the large steel circle they may be used to measure. They range in size from two inches up, but the larger sizes are really seen especially those measuring more than three feet.



Electric Device Subs for Heart

WHEN does life cease, and physical death occur? Apparently not even after the heart has stopped, according to reports of a remarkable instrument invented in Russia which mechanically takes over the function of the heart. The electric "heart" was tried out on a dog officially pronounced dead. In a few moments, it is said, the machine started up the animal's circulation again, its eyes opened, and for several hours it gave signs of life and reacted to tests for the perception of light and pain.

Radio "Eyes" for Ships in Fog

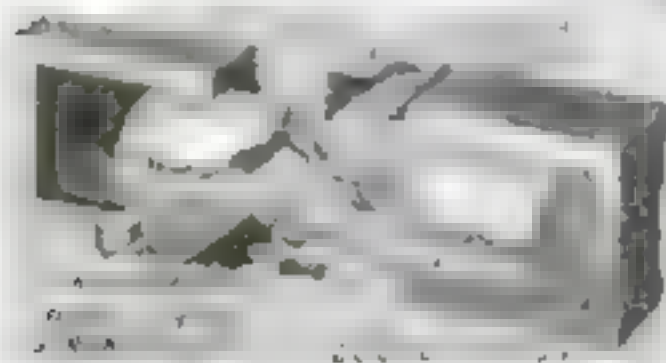
WHEN heavy fog blankets the sea and an approaching vessel might be seen too late to avert a crash, radio beams may in future automatically warn of the ship's approach, if a remarkable new device comes into general use. Dr. F. A. Kolster, inventor of the well known radio compass, has perfected the new electric beacon, which, he says, automatically broadcasts a warning signal over a ten-mile radius to other ships in the path of the oncoming vessel. Installed in the pilot house and independent of the ship's wireless, it is turned on in foggy weather. Other craft locate the signals and take steps to avoid a collision through the use of the radio compass, which tells the direction the signals are coming from.



Austrian Invents Rotary Motor

OF REVOLUTIONARY design, the gasolene motor shown vented six at Vienna, Austria, is said to be the most efficient of its kind. A series of four pistons, each of a different size, are arranged in a row, each piston working in its own cylinder. The pistons are connected to a common crank shaft. A power is taken from the crank shaft, and the motor is said to be the most efficient of its kind. It is said to be the most efficient of its kind.

At right: The world's biggest ship's hawser, below, has to be transported in a special freight car of a size to accommodate its huge bulk. Nearly a quarter of a mile long, the mighty cable weighs nearly five tons, and measures a full fifteen inches in circumference.



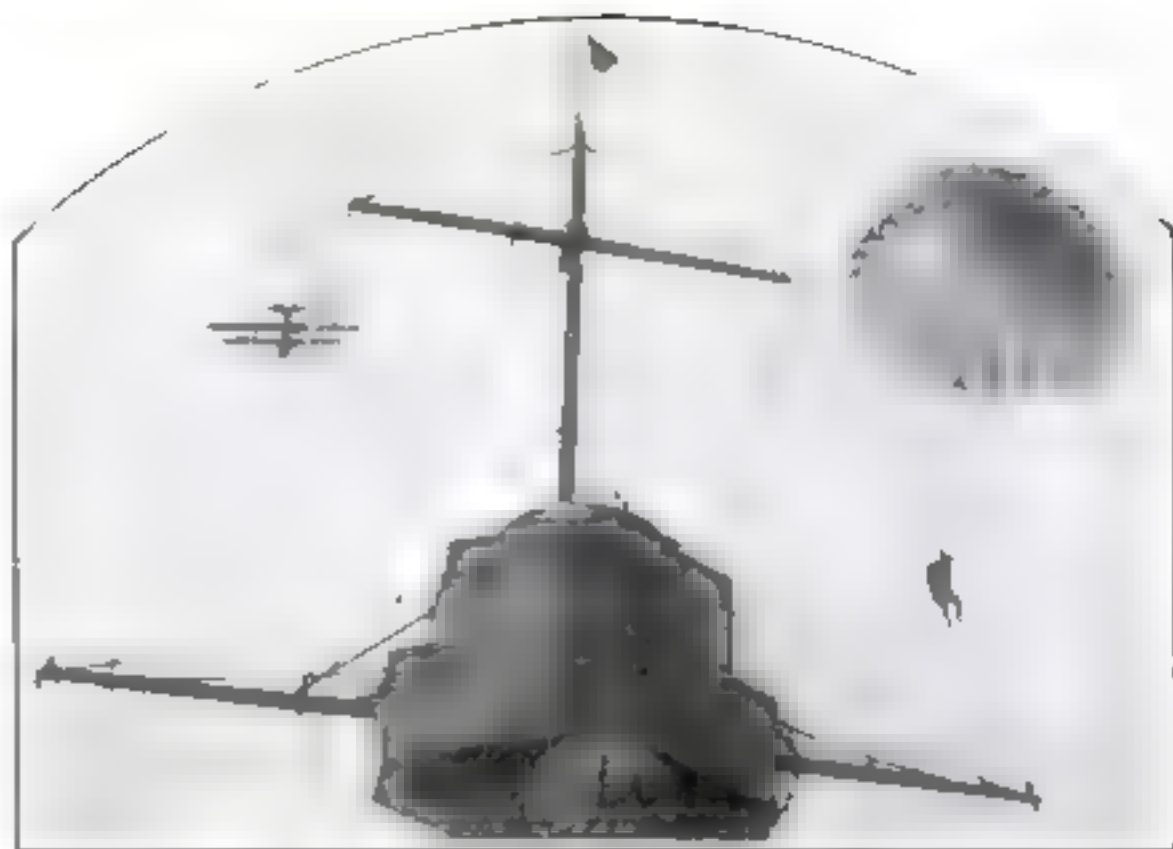
Amazing Engine Has Fewer Parts

OF EXTRAORDINARY design, a new auto motor having no connecting rods, wrist pins, or crank case, and said to allow twenty percent more mileage to a gallon of gas, has just been invented by John A. Bosmans, of Brooklyn, N. Y. Owing to its simplified construction, Bosmans says, its efficiency is doubled and he can take the motor apart, remove the crank shaft and put it all together again in thirty minutes. The same simplicity, he declares, will decrease its cost of manufacture to a fraction of the present cost of an equally powerful engine.

Eight cylinders are set in horizontal blocks on opposite sides of the motor.

There are four double-headed pistons, each working in two cylinders. As one cylinder fires, the gas in the opposite one is compressed, and a moment later the cycle is reversed. Power reaches the crank shaft through a four-sided bearing that rides in a diagonal groove within the piston, and each revolving bend of the crank shaft is entirely contained inside the hollow piston shell.

More than twice as long as in ordinary motors, the unusual piston cannot wobble as much as a short one within the cylinder walls, hence it will not wear down the piston chambers and make regrinding necessary. Absence of vibration and unusual fuel economy are other results claimed for this remarkable construction.



Parachute Jumper Misses Death by Inches

THIS parachute jumper had a few tense moments when he catapulted from a speeding scout plane directly over the dreadnaught *California*, during recent maneuvers of the Pacific Fleet off San Pedro, California. A lucky wind bore

him safely past, but at the moment that this remarkable picture was taken he barely missed the jagged spars that would have slashed his parachute and sent him hurtling to the deck far below. Fortunately, he landed safely on the water.



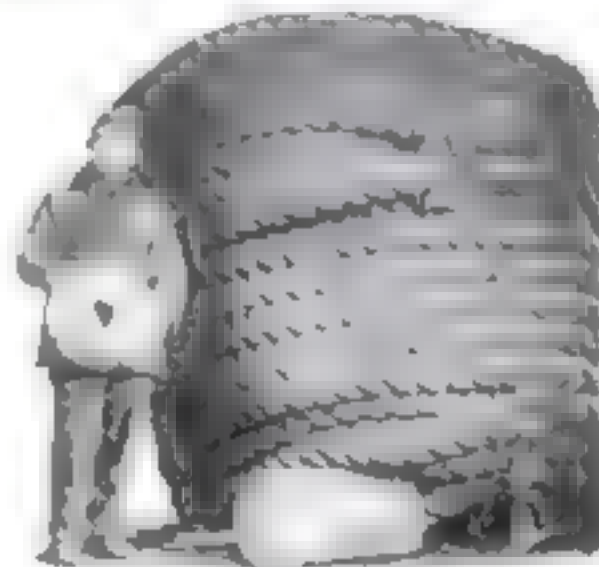
New Auto Light Reduces Glare

DAZZLING glare is said to be reduced to a minimum, in a new type of automobile headlight invented in Germany having two separate light bulbs, one used for a strong beam straight ahead and the other arranged to throw the light downward. The change from one type of beam to the other is made by a foot switch.

Giant Rope Weighs Five Tons

DELIVERED a few weeks ago to a Boston, Mass., firm of shippers, this record-breaking ship's hawser, below, has to be transported in a special freight car of a size to accommodate its huge bulk. Nearly a quarter of a mile long, the mighty cable weighs nearly five tons, and measures a full fifteen inches in circumference.

With such ropes, giant craft may safely ride out the fiercest gale. Ordinary ship's hawsers average from five to ten inches, and from 500 to 3000 pounds.



The world's biggest ship's hawser looks its size, contrasted with a coil of ordinary sized rope.

School Opens Butcher Course to Women



Learning how to swing the butcher's knife and handle his saw and chopper

MODERN women are abandoning the rolling-pin for the cleaver. Judging from this picture from the Smithfield School, Saffron Hill, London, England, where the recent admittance of women to the butchering course has met with amazing response. The young women are serious workers and soon become adept at swinging the formidable tools hitherto regarded as exclusively masculine property. The course includes thorough instruction in the anatomy of

the animals we eat, in the questions of preservation and refrigeration, and in modern butcher shop sanitation. The photograph shows women students chopping, sawing and cutting meat.



Tobacco Pouch "Pours" Easily

HERE is an all-metal tobacco "pouch" that will not grind your pet mixture to ill-tasting dust, nor spill tobacco over the user and floor in filling a pipe, according to the inventor. A small section of the hinged lid opens to release an easily controlled flow of the brown grains, and the whole lid swings back when the case needs replenishing. It fits in a vest pocket, and holds a day's supply.

New Autogiro Model

RADICAL changes have been made in a new model of the "autogiro," a strange helicopter-airplane hybrid, by its Spanish inventor, Juan de la Cierva, whose first successful machine of this type was described some months ago in POPULAR SCIENCE MONTHLY. In the original design, four huge horizontal windmill-like blades pivoted on a rigid shaft above the plane helped to support it in flight. The new model enables this shaft with its blades to be tilted during flight to meet varying air currents. The shape of the "windmill" blades is also changed. Four wheels replace the original two, with brakes on the front pair that bring the craft to a stop in a short space.

Silent Rifle Penetrates Steel

SHOWN above is the remarkable "silent rifle" recently reported from Germany, with its inventor, Hermann Pfeth, a Berlin locksmith. The rifle uses, instead of powder, compressed air. Twenty-five bullets are contained in its magazine, which can be fired automatically, without reloading. How he compresses the air to propel bullets at rifle speed from the muzzle, Pfeth refuses to disclose. But in tests in the presence of Reichswehr officers, the bullets are said to have penetrated three millimeters (nearly one eighth of an inch) of steel at a distance of more than a mile!



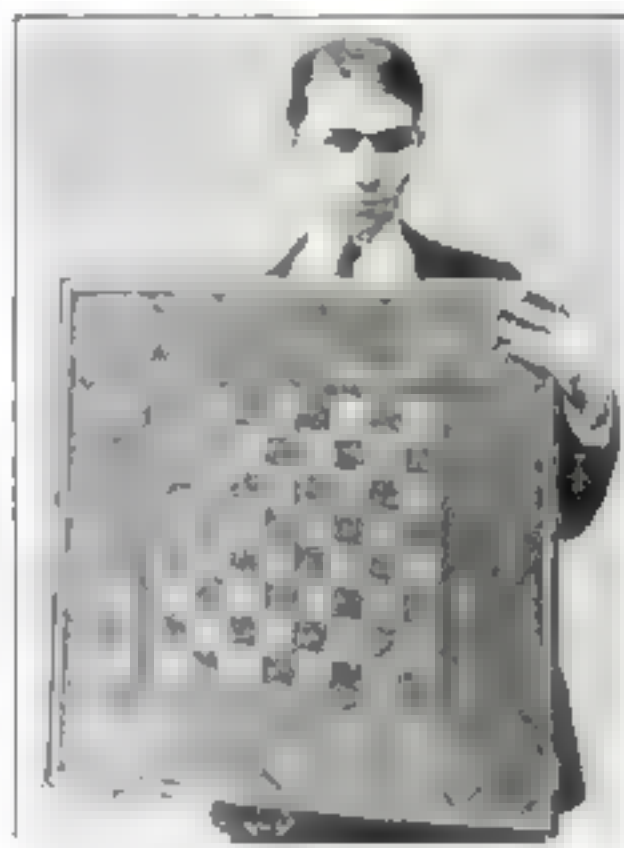
KNOW YOUR CAR

MODERN automobile transmissions and rear axle assemblies have been so perfected that trouble with these parts is becoming quite rare on any make of car until it has been in use for thousands of miles of driving. In fact, these parts of the car will go on giving service even when they are badly neglected. Neglect most often takes the form of lack of proper cleaning-out at regular intervals of 5,000 miles, and failure to lubricate with a fresh supply of transmission oil.

Aside from proper lubrication, the chief cause of excessive wear on the transmission or rear end of a car is harsh gear shifting and attempting to accelerate too rapidly. Just because your car is capable of getting away in a flying start is no excuse for making it perform that way all the time.

For long and satisfactory service from the transmission and rear axle assembly of your car, follow these rules:

1. Clean out old lubricant at least once every five thousand miles.
2. Always use the grade and make of lubricant recommended by the car manufacturer.
3. Let the clutch in gently and pick up slowly.



Checkerboard of 14,000 Pieces!

FORTY-SEVEN thousand separate pieces of wood are contained in this amazing checkerboard, made by Henry J. Bellarta, Jr., a young mechanic of Portland, Ore. Mahogany, maple, oak, cedar, birch, black walnut, hickory, gumwood and ash were all used in working out the intricate design. The board is twenty-six inches square, and the wood inlay is made up of three-sixteenth-inch blocks. It took Bellarta eighteen months to complete.

Miniature Golf Course for Business Men



Enjoying a round of golf on New York's new indoor course between business appointments

Invents Pump for Oil Wells

AFTER several years of experimenting, Archie C. Csanosky, a young oil operator of Texas, invented a novel pump which, he says, will take oil, sand and water from the deepest part of any oil well.

The pump consists of a series of tubes, as shown in the illustration, which are connected by a series of valves and a pump rod, and a power pump.



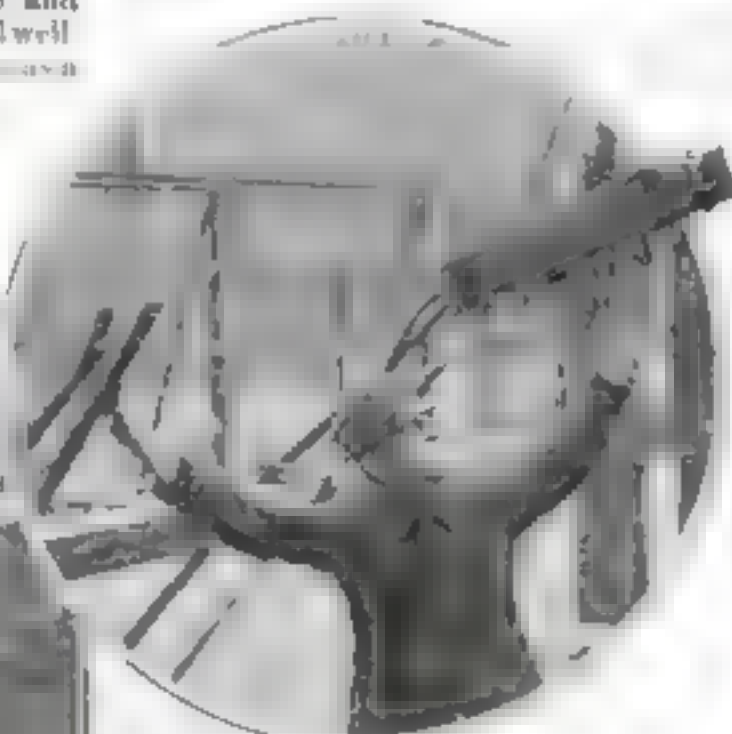
Handy Blotter Fits on Pen

FASTENED to the clip of your fountain pen, this diminutive blotter, illustrated at the right, is always at hand when you need it. The flat part of the clip carries three small pieces of blotting paper, just big enough to use on a signature or short memorandum. The rectangular shape of this part keeps the pen from rolling about on the desk and protects it from breakage. An Illinois business man invented this ingenious device to aid him in the rapid signing and blotting of his busy correspondence.

GOLF between appointments is now possible for New York business men on a miniature 18-hole course located in the heart of the financial district. Each "green" requires a

different style of approach, and ingenious hazards call forth every club in the golfer's bag.

The player "tees up" his ball on one of the raised rectangles and tries to sink it in the corresponding hole. If the ball rolls over the side to the floor, which is the "rough," it is replaced at the cost of one stroke. A few holes, such as the one in the center of the illustration, are straight and level, but most have curved approaches and tricky inclines. At the left is a hole which must be approached by hoisting the ball over a fence.



What An Angry Elephant Did

THE ANGRY ELEPHANT, a small, thick-skinned, scaly-skinned, pond-rats were buried about 100 straws. The keeper above, is a the wreck. Now they've built the elephant a new that is twice as



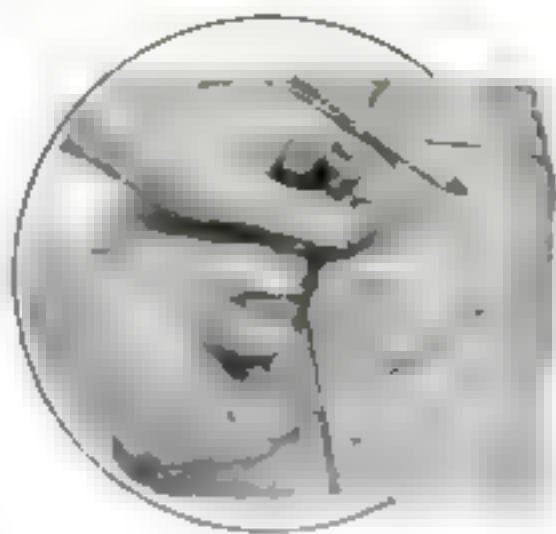
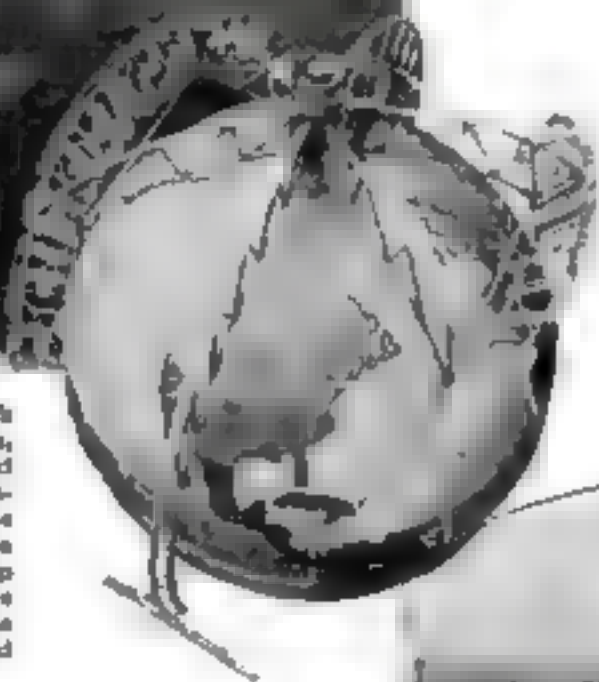
How Much Do You Know of the World You Live In?

IF you are as observant as you should be, you ought to be able to answer at least half of the following questions, selected from hundreds sent in by readers. Turn to page 147 for the correct answers.

1. What is the greatest astronomical observatory in the world?
2. Where are diamonds found in the United States?
3. Why is the magnetic compass useless in the Arctic regions?
4. Where did the Aztecs get their stores of gold?
5. What land did Columbus first discover?
6. Where is platinum found in America?
7. What city has sidewalks built in two stories?
8. What is the hottest place in the world?
9. Which are the oldest mines in the world?
10. What are the monsoon winds?
11. Where is the most active mixture of races going on?
12. On what island is Honolulu?



Hoisted nightly by a derrick over the Parkian boulevards, this dazingly illuminated globe stands out conspicuously against the sky, the latest advertising idea of a round-the-world steamship company. Around the face of this novel globe travels a ship, also electrically lighted



You won't lose your pencil when you need a moment if it's tucked in this handy pencil holder that slips over your index finger. The ring is adjustable for any thickness of pencil, and leaves both hands free to tie up bundles or for other tasks

Here and There *with the* Inventors

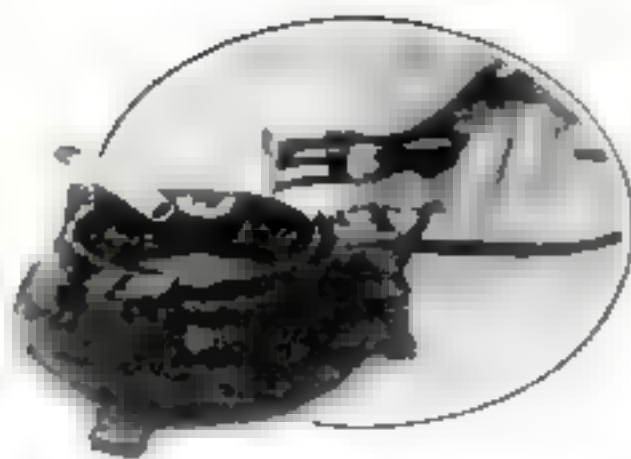
Through the water off Los Angeles, Calif. a few weeks ago, raced the amazing little motor boat, the *Bullet II*, to hang up an unofficial world's record for outboard motors of 23.13 miles an hour. Owners of high priced craft received a profound shock for the small speedy craft cost its designer and constructor, Dr. R. P. Fisher exactly twelve dollars to put together exclusive of the motor



Hit the front pin true and squarely and all the rest will topple—but it's harder than it looks, explains George Allen, of Georgia, to Bobby Jones, golf champion (left, standing). Skill at putting is the object of this golf bowling game, which Allen invented

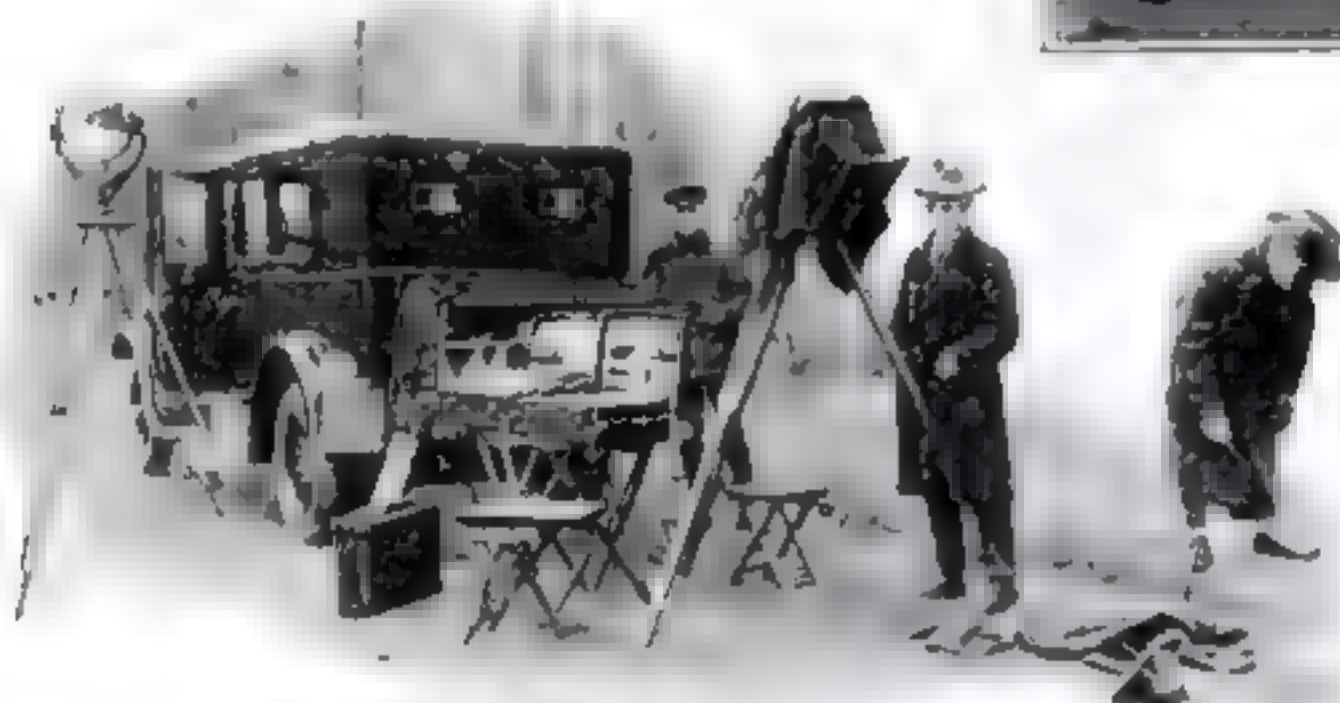


Smaller than the can that oils it, this microscopic gasoline engine, built by William A. Bruno, of New York City, chugs like its big brothers as it develops its maximum capacity of one eighth of a horsepower. Gasoline and oil tanks attached to the wall are in proportion, as is the tiny spark plug



This new gas lighter resting on the side of the car is a new design by the author. It is a new design by the author.

Amazing Speed Boat Built for \$12, Midget Gasoline Motor, Auto Crime Laboratory, Cigar Lighter and Other New Devices



Serving a double purpose, this globe lighting fixture with its minimum incandescent power consumption is a new design by the author. It is a new design by the author.

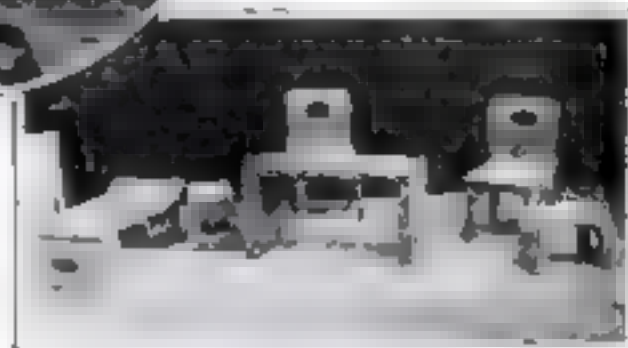
Hot on the trail of a criminal, this is a new design by the author. It is a new design by the author.



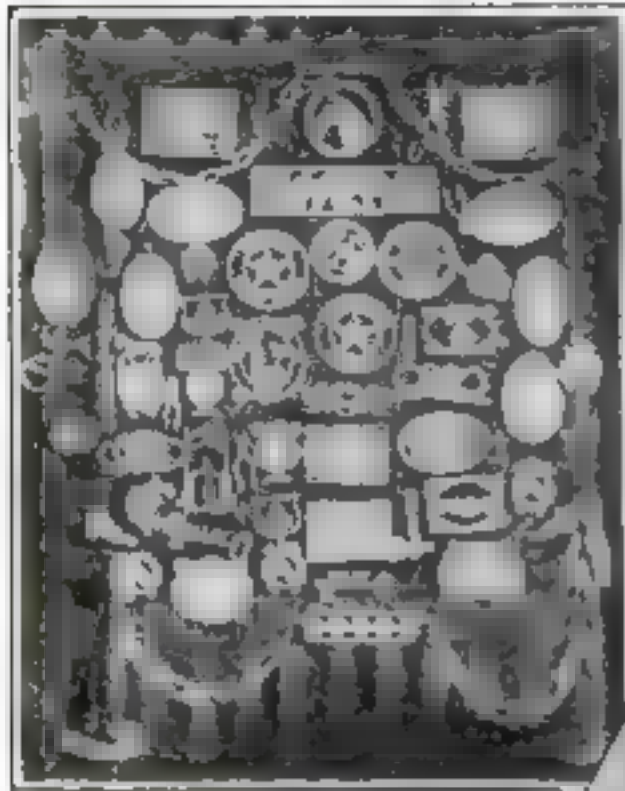
When you breathe, just what happens inside your lungs? Scientists have devised this amazing array of equipment shown recently in Washington, D. C., to discover the chemistry of breathing. The apparatus at the left measures for and via the air, but the other, studies while at the right another row of bottles collects the various products of his respiration.



Out of a single block of wood, this is a complete set of a furniture and by means of a piece of wood, the set is a new design by the author. It is a new design by the author.



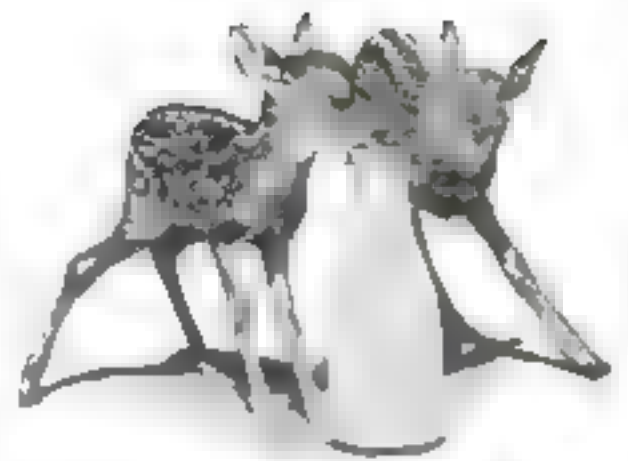
He Whittles Chains from Toothpicks



Some of D. D. Rankin's whittlings and, at right, the master whittler himself, making the twenty pairs of pliers, which fold back again into one stick of wood.

TWENTY miniature pairs of pliers which unfold from a strip of wood a quarter of an inch wide and sixteen inches long, is only one of the whittling feats claimed by David D. Rankin, of Detroit, Mich. To pass the time on a rainy day, he will carve a five-link chain from a toothpick, and one with ten links, or, perhaps, three pairs of pliers, from a single ordinary matchstick.

Some of the intricate pieces which Rankin has carved from wood are shown at the left, including ornamental designs and emblems, in bas-relief and openwork, chains, the longest of which measures twenty-three feet, and tools.



Half-Pinters—Quart Appetites!

SCARCELY larger than the bottle of milk they are feeding on, these half-pint deer, newest arrivals at the San Diego, Calif., zoo, are seen taking their eleventh breakfast in one morning. When only five minutes old they were jumping about with the lusty vigor of young bucks. They weigh only nineteen pounds each just now, but give them time!

World's Largest Searchlight

A SINGLE beam of light from the world's largest searchlight near Paris will soon guide night-traveling airplanes southward from the coast of France at the point where they arrive from England until the aerial lighthouse at Dijon picks them up and directs them with another beam on to Marseilles.

Thus light, powerful enough to pene-

Ship Models of Bone

TO THE ever-increasing list of specialized professions must be added that of T. Beaufort of London, England, whose unusual occupation is the restoring of bone models of historic sailing vessels. Some of the models, the details of which are carefully made to scale, were the work of French prisoners at the time of the Napoleonic wars. Bones from their own tables and the cooks' kitchens were the only materials they had to use, yet with these they shaped and polished gracefully curved planks for the ships' sides, worked out every detail, and finished their work off with delicate carving. At present the miniature replicas are worth from \$1250 to \$5000.

Mr. Beaufort is shown below checking up the measurements of one of the damaged ships he is repairing.



Restoring ship models of bone his unusual occupation: T. Beaufort, above, shown checking the dimensions of an old warship model, which is complete in every detail.



The Good brothers in the workshop, where they construct models of famous steamships.

They Made a Hobby Pay

TWO brothers of Pasadena, Calif., Wallace and Roscoe Good, are shown above at work on a model of the S. S. *Malolo*, one of the largest steamships ever built in this country, which is to be placed on the San Francisco-Honolulu run this spring. The building of steamship models, first taken up as a pastime, has developed into a profitable business for the brothers.

The model above, scaled down to one eighth inch to a foot, is seventy-three inches long. Every detail of the construction is reproduced in exact proportion, the model being constructed from the blueprints used by the builders of the *Malolo*. The hull and superstructure are pine, the davits and anchors white metal, and the propellers and fittings brass.

late heavy curtains, is located at the top of Mt. Valerien, the highest point in the immediate vicinity of Paris. Its twin reflectors measure each about six feet in diameter and its arcs are lighted by a hundred-horsepower plant.

While the expense of running such an outfit is naturally great and the light will be used only when needed, it is expected to handle the regular commercial airplane service from London to Marseilles.

New Loud Phonograph Invented

A REMARKABLE new phonograph said to have the tone volume of twenty orchestral instruments is a new invention reported from Germany. Tone volume is said to be augmented by the influx into the soundbox of a mixture of atomized air and oil generated by a hand pump and projected to the resonator.

Last Word in Aerial Railway Luxury



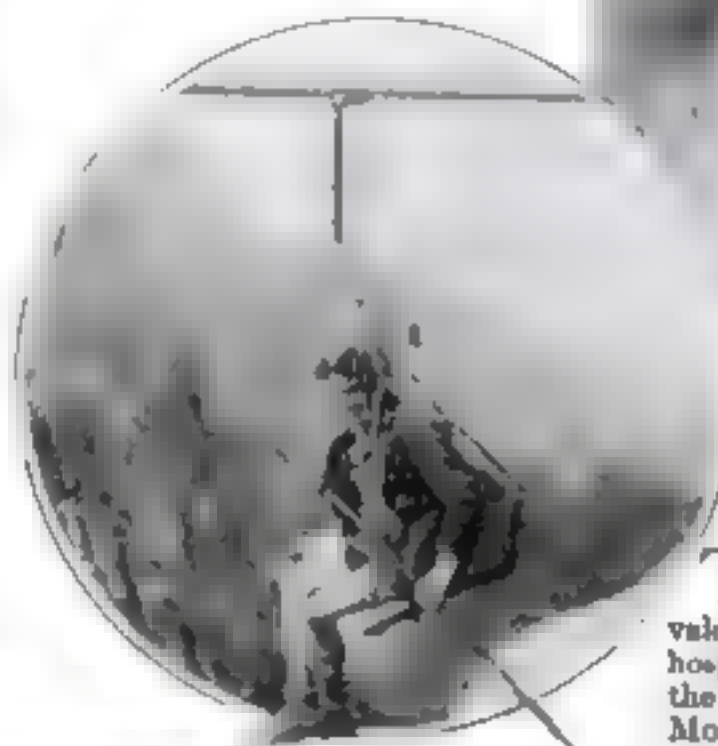
Now—the Airplane Trunk!

YOU can carry an entire wardrobe in this ingenious new piece of baggage, which, though the size of an ordinary suitcase, has the capacity and clothes protection of a wardrobe trunk. Designed for the limited accommodations of airplane travel, it is equally convenient as a space-saver on a train, where it slides out of the way under a Pullman seat. It would also prove useful on an automobile or steamer trip.

Within its modest dimensions, according to the maker, is space for four suits, two extra pairs of trousers, and other articles of a man's attire; or, in the model for women, twelve dresses can be tucked away, with plenty of room to spare for incidentals. When the case is opened, hangers that keep the clothes from wrinkling may be drawn forth for ready access. The model illustrated is only nine inches deep.

SUSPENDED high above the Bavarian Alps, the workman below seems as comfortable and unperturbed as the occupant of the luxurious cabin at the right, which is the standard rolling equipment on the new Alpine aerial railway up the Zugspitze, recently completed. The occupant of the cabin is no less a personage than the president of Austria, Dr. Michael Haunisch, who took the first ride over the cables. The workman is inspecting the cable to make sure everything is secure for the inaugural trip.

The new railway is nearly 10,000 feet high, and runs to the summit of the highest mountain in the Bavarian Alps, the Zugspitze.



Above, type of car used to carry sight-seers to the top of the Zugspitze in the Bavarian Alps. Left, Workman making a tour of inspection of the newly erected cable before the initial trip.

His Galleon Wins Prize

THIS model of a Spanish galleon, illustrated below, made by a convalescent patient in a New York City hospital after the design first published in the May, 1926, issue of POPULAR SCIENCE MONTHLY, recently brought a substantial sum at a benefit sale for shut-ins held at the Women's City Club of New York. The illustration shows Bird S. Coler, public welfare commissioner of New York City, buying the model from Mrs. H. Edward Dreier, president of the club. The constructor of the model has skillfully and faithfully carried out the majestic lines of this type of Spanish fighting ship, which was also used for the transportation of gold.



A Speed Boat Disaster Made to Order

SNAPPED just as the racing speed boat blew up with a terrific detonation and a shower of splintered wood and flaming gasoline, the remarkable photograph above shows what horrified spectators witnessed the other day at a race at Newport Bay, near Los Angeles, Calif. No one was injured, however, in the spectacular explosion, which was staged for a movie thriller. The pilot of the demolished craft leaped to safety a moment before the explosion, and was

picked up by another boat. Clever photographic work will eliminate the leap overboard from the completed photoplay, making it appear as if the "villain" perished in the blast.

SPIRITS OF TURPENTINE is made from the sap of trees—in America from the long leaf pine—the sap being drawn from the tree much as maple sap is. Distillation causes a thin fluid, which is turpentine, to separate from the mass.



This magnificent model of a Spanish galleon was built by a patient in a New York hospital.



Freak Tree Loops the Loop

WHEN it was only a few feet high, this tree apparently decided that it didn't like the world's looks, so it turned back in the direction it came from. Then, after a while, it started life over again, and the result was the curious freak of nature in the illustration. Notwithstanding its unusual shape, it is a healthy and thriving specimen.

Trees, of course, have been known to overcome amazing obstructions in seeking a path for growth, even dislocating floorings and walls in buildings underneath which they had taken root, but the forest ranger who came upon this one could discern no apparent obstacle to its normal development.



Meet the Acrobatic Musicians!

PLAYING twenty-odd instruments at the same time is a simple matter if you use your mouth, elbows, fingers, knees and feet simultaneously, say these two brothers, Cicero and Abner Weaver, founders and sole members of the Arkansas Jazz Band. Cicero, at the left, is demonstrating a quaint instrument of his own design. Combined with it are a few bells, an automobile horn, a cymbal and a pistol (attached to the end).

A tambourine, two cymbals and another noise-maker of original design and fearful results are strapped to Cicero's legs. Abner's curious banjo-mandolin supports a horn, too, at the right height for his mouth. The odd looking rake is really a "flute" and the musical saws and zither complete the outfit.

The brothers have been touring the country with their unique instruments,

Rides Off Cliff, Parachute Fails to Open!

WHEN Fred Osborne, daring air pilot of Santa Monica, California, drove a motorcycle at high speed over the edge of the Huntington cliff north of that city recently, he carried on his back a parachute that he expected would lift him from the saddle and float him down gently to earth. The parachute failed to open. Man and motorcycle went hurtling into space and plunged toward the ground far below, where the spectators watched horrified.

By a miracle Osborne was not killed outright, his dizzy fall being broken by telephone wires. He was carried from the beach in a critical condition. The motorcycle, a twisted mass of wreckage, burst into flames. Notice the half-opened parachute at the left of the photo below.



Osborne at the moment he expected his parachute to open. Left, after the crash.

Old and New in Strong Boxes

A CENTURY ago, people kept their valuables in strong boxes like the one in the picture below, with iron padlocks and creaking hinges. Just behind it is the last word in theft-proof deposit "boxes," the new vault of the Bank of America in New York City. Note the complicated locking mechanism, with its train of gears that operate formidable bolts all around the rim of the circular door, and the massive hinges, smoothly supporting the tons of hardened steel that hang from them.

The old strong box in the picture is said to have been captured by the British troops during the War of 1812.

A RED diamond weighing eighteen carats has been reported found in the Lichtenburg diamond district, South Africa. Red diamonds are very rare and command high prices.

Pale Hands Warm, Red Cold?

WHITE hands, contrary to general belief, may be warm, and red hands cold, according to a report to the recent congress of the Society of German Natural Philosophers and Physicians at Dusseldorf. The warmth of the hands depends solely upon the amount of blood supplied to them, it was pointed out. The color, however, is determined by the position of the capillaries.



Edward C. Debafield, president of the Bank of America, New York City, contrasting the "strong box" of a century ago with the mighty geared doors of a modern safe deposit vault.

Remarkable Kite Built to Carry a Passenger



The Argabrite kite in a test flight at Los Angeles. At the right the kite is shown before the flight, with Mrs. Argabrite in the cockpit her husband holding one of the ropes and friends the other

SIX men have all they can do to hold this giant man-carrying kite by long ropes while it soars aloft. It has carried its inventor, George A. Argabrite, of Los Angeles, Calif., far above the earth more than two hundred times without mishap. As seen on the ground, in the picture below, its lines suggest an airplane. In flight, the lower half is visible as a wing and tail combined, completely obscuring the figure of the passenger.

Two separate ropes are used to steady the man-carrier in flight, one attached to the bottom framework at the front and the other near the tail. Complete landing gear, including four small rubber-tired wheels, insures a smooth descent. A dummy was the passenger in the first trial flight, which demonstrated that the machine would carry Argabrite's 180 pounds aloft in complete safety. The kite can also be anchored in the air, and used for observation purposes.



Tiny spiders, the highest-up animals on earth, have been found living 4,000 feet above any vegetation on the slopes of the Himalaya mountains in Asia. Since they are entirely surrounded by snow, ice and rock, the minute creatures must eat each other for food.

Who Says Bike's Out-of-Date?

YOUNG America demonstrates, however, that, far from being out-fashioned, the bicycle is still a highly popular method of locomotion. This small army of two-wheeled vehicles is not the start of an international bike race—it's just an everyday scene after school at a junior high school in Los Angeles, Calif., where 300 pupils "bike" daily to and from their homes and school. Parking space has been provided by the school authorities.

First Eel Egg Found by Woman

THE origin of the common eel, a mystery since ancient times, is solved definitely at last. The discovery of the first eggs of the American eel ever obtained was reported recently by a twenty-five-year-old woman scientist, Mrs. Marie Poland Fish, biologist of the U. S. Bureau of Fisheries.

The eggs came from the depths of the sea south of Bermuda. Mrs. Fish found them while she was at work sorting marine specimens which had been brought to the surface in a trawling net. Later one of the eggs hatched and the larva was identified.

The mystery of why men for centuries have searched in vain for eels' eggs was solved by the discovery that the American and European eels, unlike any other known creatures, live in fresh water but go to the ocean to spawn.



Tropic Fish Has Nest Like Bird

AN ODDITY of nature, this strange fish, of the genus *Epinephelus*, found in the tropic seas of India, weaves a nest of seaweed in an underwater tree. Like a bird, it lays and hatches its eggs within the nest. It is easily frightened and changes color when a funny enemy approaches too close.

Microphone for Witnesses

JURORS don't have to strain their ears to catch every word of a witness's testimony, in a Baltimore, Md., court room, where witness's words, spoken in a low voice into a microphone, are amplified by a loudspeaker for the judge and jury. Supreme Court Judge Joseph N. Utman has installed the system in his court room.



Pressing one button records one stroke; pressing the other one sends hand recording the number of strokes per hole back to zero

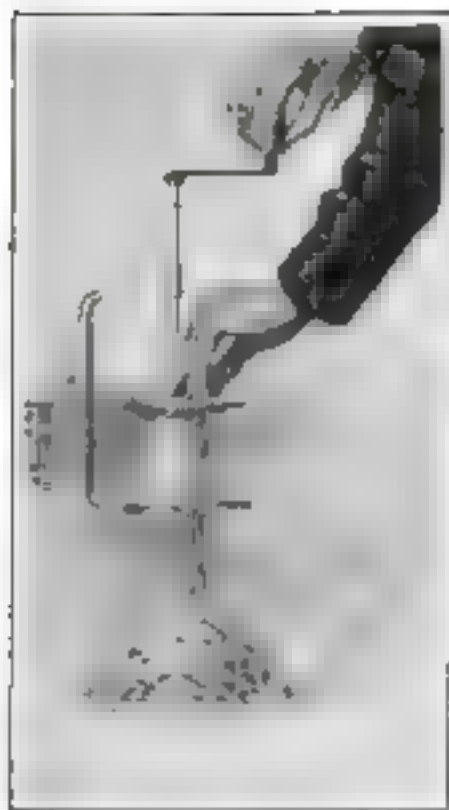


No special bus service is needed to take these Los Angeles boys to and from school

Golf Watch Ticks Off Strokes

WITH this new counter, there can be no argument as to whether the golfer took six or seven strokes to make a hole. After each shot, he presses a button to register it on the counter; when he has "holed out," another button returns the pointer to zero ready to record the strokes of the next hole. Resembling a watch, and strapped to the wrist, the golf meter records this score on its "minute hand," and an "hour hand" totals the strokes for the game.

Sixteen Ways to



Not only does this ingenious machine slice fruits or vegetables to any thickness, it also "shortens" them or cuts them in any shape desired for use in salads and fancy dishes.



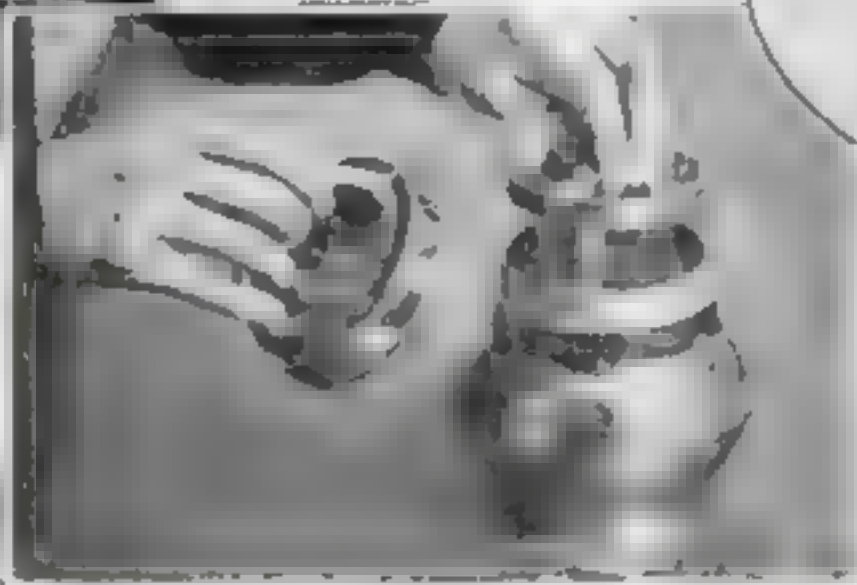
Is there water in the milk? The housewife can tell in a jiffy, with the testing instrument shown above. It reveals whether milk is skimmed, unskimmed or watered, according to the last number visible on its scale as it floats in the liquid.



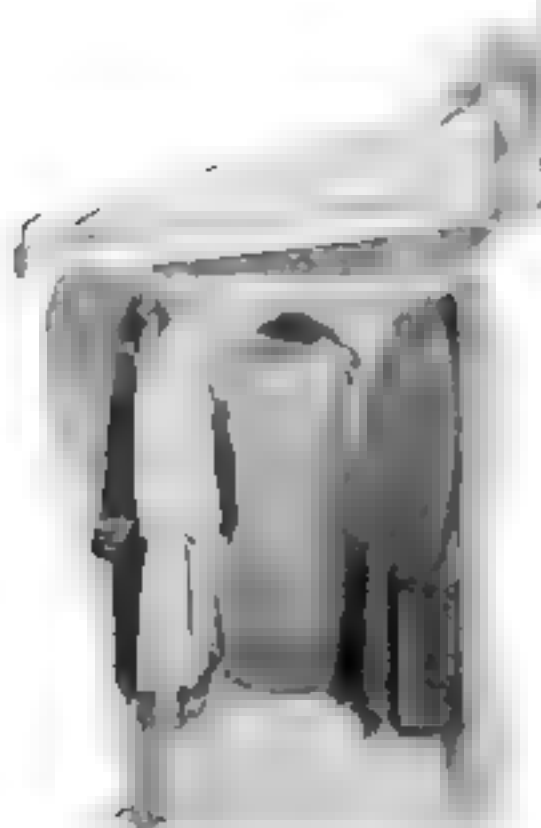
A one-legged table can have many uses when built to fit armchairs as neatly as the one above. Adjustable to any height, it lies flat for picture or sewing, and stands for writing, drawing or reading. The leg folds up against the top.



Steam-poached eggs are easily made in this new poacher, with its tray of individual removable cups, to lower pan for boiling water, and its deep cover for steaming.

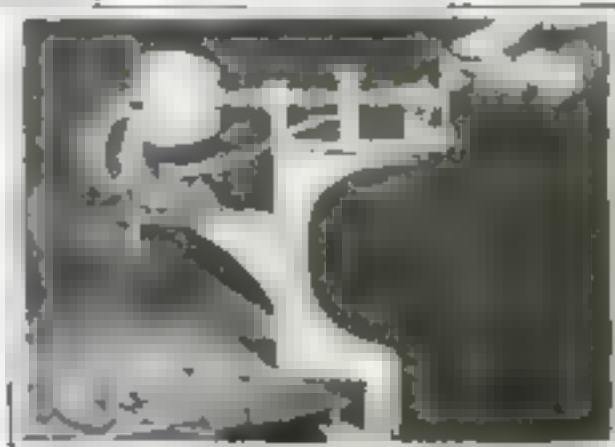


Knives can be sharpened in a jiffy with this handy grinder. Place the knife between the wheel of abrasive material and one of the adjoining metal cones, draw the knife back and forth, and the job is done.



Closet space, always at a premium, is made the most of by a new type of clothes hook, illustrated at the left. The hangers may be hung at once from its notched edge. The notches prevent hangers from slipping off or crowding together. Only three such hooks are said to be sufficient to equip an ordinary small closet.

Used for making beef tea and other meat extracts, this little cooker is placed in water in an ordinary saucepan. With meat or vegetable and a small quantity of water within, the device is sealed and heated in boiling water until the full flavor of the potest has been extracted.



Peeling potatoes or apples loses its drudgery when all you do is turn a crank, as with this ingenious peeler. A sharp knife removes the peel in one piece as the shaft holding the apple moves lengthwise on a screw.

Lighten Home Tasks



A marvel of compactness, the novel 'housekeeping cabinet' above is equipped with a two burner electric stove, adjustable electric light, bread box, iron and silver drawer, even a folding table and ironing board!



Clamped to the corners of the bridge table, these useful trays keep glasses and ash trays out of the players way. They are attachable, also, to desks as well as to flat-arm chairs.



One lump or two? It's dauntily done with the spring tongs built into the lid of this novel sugar bowl, so that you lift tongs and lid at once. The sugar, too, is better protected from dust.



A detachable mop wringer, adjustable to any size pail, is a new aid in floor mopping. To use it, rollers are pressed together with the foot and the mop is pulled through easily with the hand.



For that hasty morning shoe shine, here's an outfit that will save the furniture and your back. Around the foot rest runs a wire bar. Passed over the shoe and under the bar on either side the polishing cloth can be handled easily from an erect position.



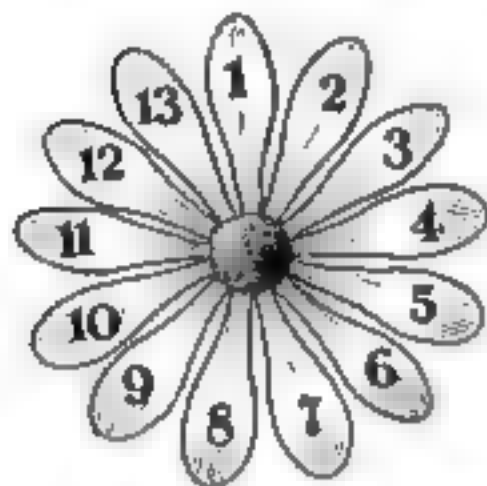
Two sets of bristles are the feature of this novel comb cleaner. When you squeeze the handle, tufts of bristles run through the comb from each side, leaving it clean.



A "zipper" fastener is a feature of a new wastebasket bag, closing the bag tightly against dust and insects. A wire frame holds the bag rigid.

Sam Loyd Offers Six New Tests of Your Wits

Brain-Teasers to Show Whether Words, Facts or Figures Are Your Forte



Are You a Good Strategist?

HERE'S a new version of the daisy game of prognosticating your matrimonial future by plucking the petals of a flower. The game is played by two persons, who take turns plucking the petals. At each play the player is privileged to remove any one petal from the circle, or two petals, provided they be contiguous, none having been removed from between them. Thus the game proceeds until finally one player removes the last petal and leaves the "old maid" stump for his or her opponent.

Of course, the strategy of each game is affected by the chance numbers of petals to be dealt with, but for the purposes of our mental test we will assume that the full-fledged daisy has thirteen petals.

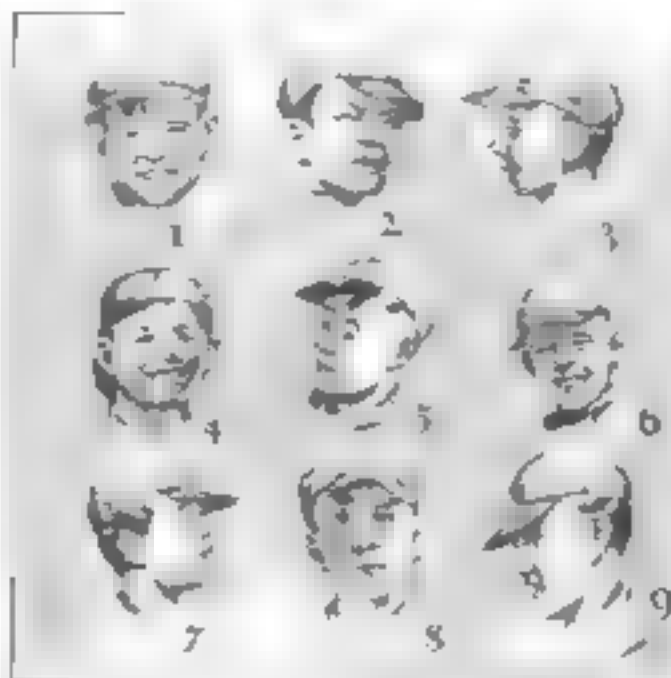
If you were starting a game with the daisy of thirteen petals and your opponent, having first play removed petal number 1, what would be your best play in reply? Which has the advantage, the first or second player? The answer and your rating are printed on page 141.



Are You Quick at Figures?

JOHNNY performed his example in multiplication; then he made a little puzzle out of it, as shown above, by erasing thirteen of the figures and challenging the family to discover his multiplier. Sister Kitty "cooked" Johnny's problem by discovering that he might have used either of two multipliers to work out consistently with the evidence on his slate. Can you duplicate Kitty's feat?

If you are quick at figures you'll follow up the clues easily. Turn to page 141 for your rating.



Do You Spot Clues Quickly?

STOP for a moment the determined physiognomies of the Young Giants, gallant team that carried off the First Ward pennant under the inspiring leadership of Smokey McMan. In the picture, they are arranged according to their ages. They are exactly six months apart—increasing by half-yearly jumps from the first to the ninth. The total ages of the first five players equals seven eighths of the combined ages of the last five.

Smokey is the smartest sixteen-year-old diamond strategist in town, so see if you can identify him from the information at hand. To see how you rank as a deductionist, turn to page 141.

Can You Find the Right Words?

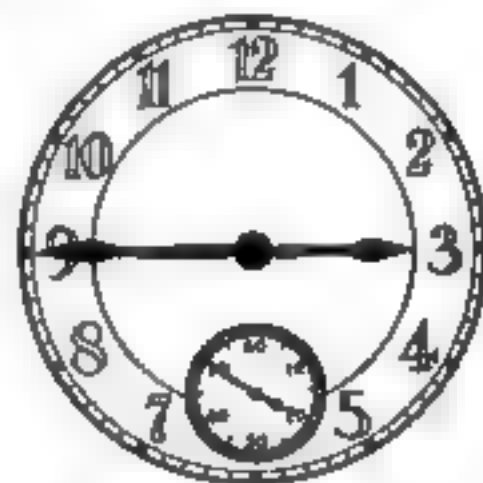
SUDD the ant to the cricket when the latter made his usual prewinter bid for a loan. "Do not think to find me a foolish fellow," said the ant, "of your self-inflicted troubles. I— you are a little chap, with a charming voice and a good mood, albeit you are somewhat of a ——— and ——— in your speech."

"Why you let the springs of industry lie ——— in the ——— season, when there is work for all of us. I ——— understand."

You must ——— that misery and ——— are invariably ——— upon unprovokedness. Nevertheless, I shall not be entirely ——— to your appeal. (On the way out of my garden you may stop at the ——— and slake your thirst.)"

Can you complete the ant's homily by placing in the blank spaces appropriate words ending with "ant"?

If you are possessed of a generous vocabulary and a faculty for quickly producing the words which most aptly express your thoughts, you should solve this without much mental agitation. Turn to page 141 for your rating.



What Was the Correct Time?

IN A recent holdup a bullet struck the face of a clock, hitting the exact center of the dial, driving the joint of hour and minute hands through the works and instantly stopping the clock. The hands were fixed in a straight line, though not as shown above, for it is evident that a correct time is not indicated. It is assumed that the hands spun about after being welded together by the bullet.

It proved quite a problem for the authorities to prove what the exact time must have been, not neglecting the clue provided by the second hand, and assuming that the three hands were running in perfect coordination. Can you do it, too? Time yourself, then find your rating on page 141.

A Test of Organizing Ability

THE figure below, taken as a whole, is composed of three similar squares, each of the four sections into which it is divided is likewise composed of three



similar squares. It illustrates how a planter bequeathed his land to four sons, treating all exactly alike. Now, the total number of square miles in the big tract was the same

as the number of linear miles of fencing that enclosed and divided it into the sections. The problem is: How many square miles of land did the planter leave his boys?

Here is a test of your ability to grasp visually and organize the factors of a concrete proposition. Time yourself, then turn to page 141 for your rating.

Sam Loyd, author of these entertaining and instructive tests, is the world's greatest puzzle maker. Are you following this fascinating page of brain-teasers from month to month?



Your wife isn't to blame, Barnes, said Gus. The brakes are just because he didn't know how to use them. And you know that big puddle down the street!

When Your Wife Learns to Drive

Gus Gives Some Pointers for the Woman Motorist

By MARTIN BUNN

NOW I suppose we'll have a little peace and quiet around here," Gus Wilson grumbled to his partner, Joe Clark, as the latter finally stopped hammering on the fender of his siver. A truck had side-wiped Joe's car on the way to the Model Garage that morning.

"Aw, quit beefing!" snapped Joe. "It's got to be fixed sometime, hasn't it?"

But Gus was doomed to disappointment, for the next moment the two garage men were startled by the sound of a crash, followed by the tinkling noise of broken glass. Dropping their tools, they rushed for the door. Directly in front of the garage a car had rammed into the rear of another car parked at the side of the road. The force of the collision had been sufficient to smash both headlights and wreck the spare tire rack on the parked car.

"Now you've done it! Didn't I tell you to put on the brake?" the owner of the car was shouting, hopping about excitedly.

His wife was still sitting behind the wheel. "But I did put on the brake as hard as I could, Dick," she protested. "It just didn't hold!"

Gus, who had been examining the brakes, now walked around to the front. "Your wife isn't to blame, Barnes," he

asserted positively. "The brakes did slip because the brake lining got all wet when you drove through that fog mud puddle down the street, and when the brake lining is wet it doesn't hold near so well as when it's dry."

"Sure, I know it doesn't," admitted Barnes, "but that only means you've got

to press a bit harder on the pedal. It's no use," he growled, shrugging his shoulders. "She'll never learn how to drive a car in a thousand years! It makes no difference what I tell her, she does exactly the opposite."

"Is that so?" snapped his wife, who by this time had recovered somewhat from the shock of the accident. "If I can't drive, whose fault is it? You just keep nagging at me until I get so fussed I don't know what I'm doing!"

"Seems to me I tell all your fault at any rate, Mrs. Barnes," suggested Gus mildly in an attempt to stop the family wrap that threatened to develop.

"In the first place, I notice that you haven't any cushion at your back and as you are not so tall as your husband, you can't reach the pedals properly or push them hard enough."

What Was Wrong with Spratt's Car?

IN THE December issue we published a story detailing the troubles of Henry Spratt with a secondhand automobile in which he and his wife had started out on a long tour. We offered a prize of \$25 for the best letter explaining the trouble with Spratt's car and telling him how to overcome his difficulties.

Guy F. House, of Lost Springs, Kansas, wins the prize. The vacuum tank float in Henry's car was leaking, and many contestants demonstrated their knowledge of auto mechanics by indicating this as the source of trouble. Only two out of the entire number, however, instructed Henry to turn his carburetor back to its original setting and showed him how to get to the nearest garage. Of these two, Mr. House, in the opinion of the judges, offered the most accurate diagnosis of the trouble and the simplest and most effective way to proceed.

"THEN it's always bad dope for a man to try to teach his own wife how to drive. No wife likes to play the dumb-bell before her husband, so she won't admit she doesn't understand everything he tells her the first time. She makes mistakes. He becomes impatient and sarcastic and the war is on. Besides, just because a man happens to be a good driver himself is no guar-

(Continued on page 14)



"No one could make Stradivarius violins by mass production"

Thomas A. Edison now answers a questionnaire

FROM his laboratories Thomas A. Edison has from time to time issued questionnaires. Now, he has consented to become the interrogated—has agreed to lay bare his half-century of effort to give the world perfect Re-Creation of music.

In plain, untechnical words, Mr. Edison here tells how he has made a marvelous musical instrument with all the painstaking care and individual detail of a Stradivarius Violin.

The questions asked Mr. Edison were:

Ques. Do you take advantage of the economies of mass production in the making of your phonograph?

Ans. I consider the New Edison Phonograph a musical instrument and not a machine to be made in the manner of automobiles, cheap furniture or other things in which uniformity is not a prime essential.

Ques. Isn't it possible to make instruments of standard quality by mass production?

Ans. No greater proof of the fallacy of this, as far as phonographs and other musical in-

struments are concerned, can be offered than the vain efforts of violin manufacturers to make violins of Stradivarius quality by mass production. For although every part of the instrument may be exactly alike as to size, unless there is the individual human touch, there is bound to be a variation in tone quality.

Ques. How can the layman tell the difference between a phonograph made by mass production and one made by craftsmen?

Ans. Anyone is apt to be satisfied with existing conditions until he hears something better. May even excuse distorted tone for want of a superior instrument. But when an ordinary phonograph turned out in quantity is compared side by side with one in which human hand work has played a part, the glaring difference instantly is apparent.

Ques. What do you consider the truest test of phonograph

There is no measure of tone as an ear. For this comparison between the New Edison and other phonographs.

In any home where comparison with other types of phonographs is desired.

Ques. How would you describe

Like a Craftsman of some old old guild like



The NEW
EDISON
PHONOGRAPH

the tone of the New Edison Phonograph?

Ans. It is sheer nonsense to speak of the tone of a phonograph or of its resonance. A phonograph should have no tone of its own. The instrument should be only a medium of Re-Creation. Obviously you should be unconscious of it and hear only the beautiful music it Re-Creates.

I worked for five years and spent more than \$1,000,000 in experimental work to remove any false tone from the New Edison. Even when I, myself, was satisfied with the results I did not stop there. I insisted that the New Edison be submitted publicly to the test of side by side comparison with living artists whose performances had been recorded. Exact music critics could detect no difference between living and Re-Creation performance. ★

Why There NEVER Can Be a Better Phonograph

After all, the phonograph serves but one purpose—to Re-Create voice or instrument with human reality. When a phonograph does this, nothing more can be asked—it has reached perfection.

That the New Edison Phonograph achieves this is fact—not theory nor hopeful expectation. During more than 6,000 tests in Carnegie Hall, New York, Symphony Hall Boston, and in other noted music centers, side by side tests were made with living artists who sang or played before a critical public in direct comparison with the New Edison Phonograph.

Famous musical critics who attended these tests found it impossible to detect the living voices or instrumental performances, from the New Edison Re-Creation. It was proved that the New Edison Re-Creation with literal fidelity and in a way that baffles the keenest ear in the effort to detect the living performance from the Edison Record.

Hear the New Edison Phonograph Record at your nearest Edison dealer. Also get him to play one of the Edison 47800 records, the most perfect achievement—a record no longer than the usual short playing record.

which reproduces music without interruption in a complete concert on one double-faced record.

The New Edison has always sold by comparison. Compare it yourself with any other phonograph and let your own ears decide.



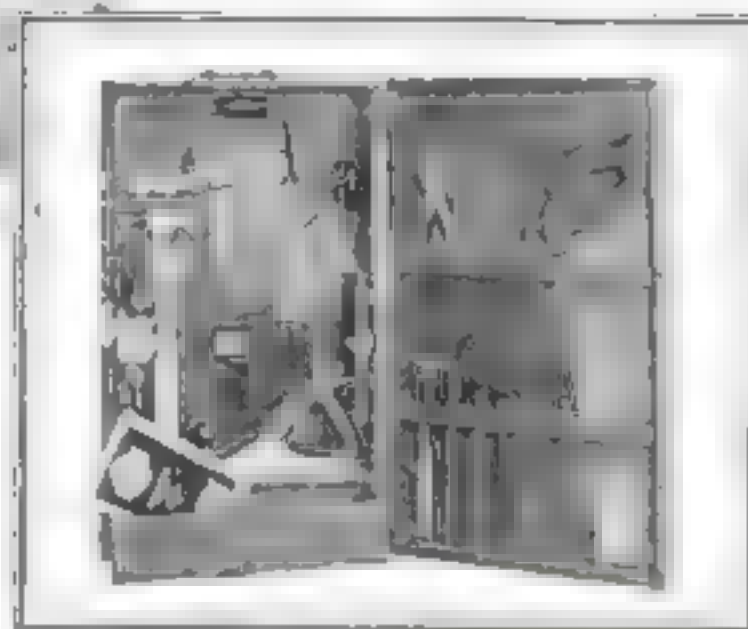
OK

Thomas Edison

★ WATCH FOR OTHER QUESTIONNAIRES BY MR. EDISON



Buy separately or in assortments



What every garden needs

IS your garden merely a growing place for grass, trees, flowers, or vegetables? Does it offer you an inviting place to rest?

The whole family will use and appreciate a comfortable garden seat. It is so easy to make a garden seat that no garden should be without one or more. Stanley Plan No. 21-E gives complete details for making such a seat.



Confidence in your tools will make any job more enjoyable. The amateur user needs good tools even more than the professional. Stanley Tools can always be depended on, as nearly every American carpenter knows. Thousands of manual training instructors use Stanley Tools in their classes. The Stanley name on

a tool is your assurance of durability, correct design, and right "feel."

You can buy Stanley Tools separately and so collect your own set. For your convenience in buying there are also complete sets of Stanley Tools in chests at a wide variety of prices from \$15 to \$95. Or there are assortments in strong cardboard boxes containing directions for making your own tool chest. Price \$5.00 to \$10.



Your hardware dealer has Plan No. 21-E as well as other Stanley Plans for making useful articles, or he can get them for you. The plans cost only 10c each. Ask him also for Catalog No. 34-E which shows the most complete line of woodworking tools on the market. It is free. If he cannot supply you write to The Stanley Works, New Britain, Conn.



The best tools are the cheapest to use
Ask your hardware dealer



STANLEY TOOLS



Arthur Wakeham Editor

New Uses for Plastic Paints

*Building an Ornamental Fireplace without Masonry —
A Treasure Chest — Walls and Ceilings — Other Novelties*

By E. M. OREN

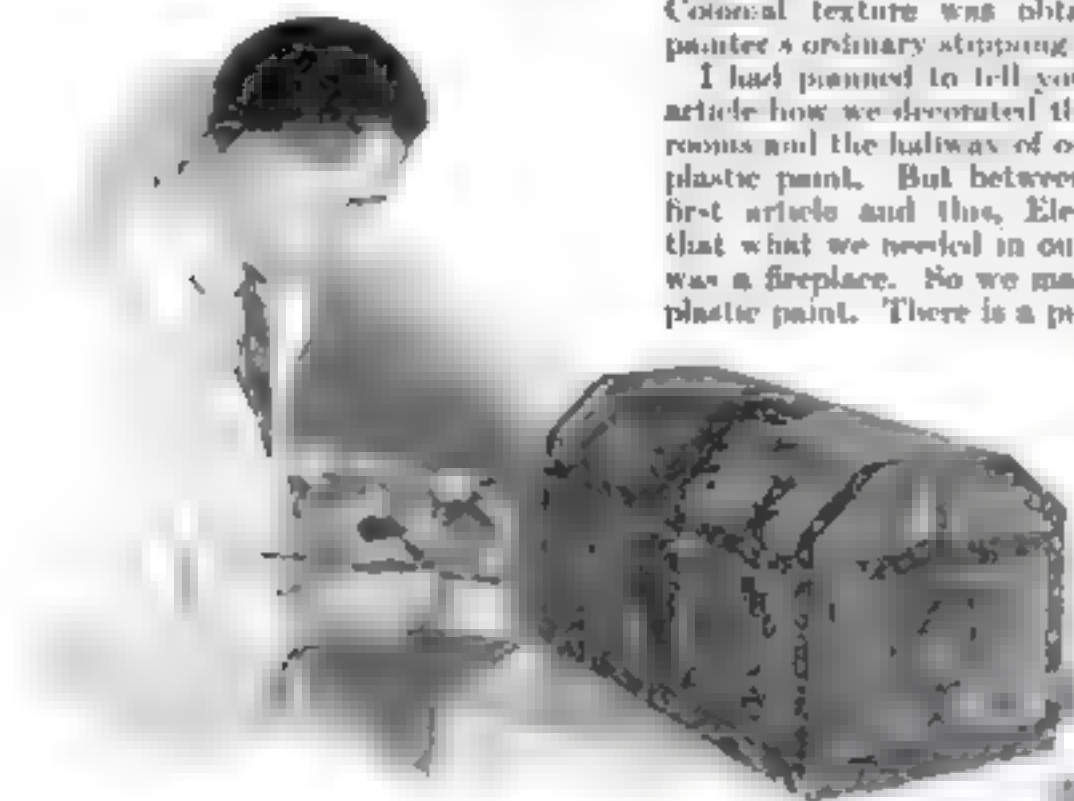
AS A RESULT of Eleanor's insistence, we had renovated the walls and ceilings of three of the rooms in our house with rough texture and color effects.

brush marks showing and then smoothing them down with the palm and the heel of the hand. The monastic texture was made with a four inch wall brush only, and the Colonial texture was obtained with a painter's ordinary stripping brush.

I had planned to tell you first in this article how we decorated the other three rooms and the hallway of our house with plastic paint. But between writing the first article and this, Eleanor decided that what we needed in our living room was a fireplace. So we made one—with plastic paint. There is a picture of it on

The first thing I made was the frame, for which I had enough scrap lumber in the basement. And I can explain in a diagram (page 70) how this was made much easier than I can in writing. After the frame was finished, it was nailed to the wall and covered with gypsum (plaster) wallboard.

Next the joints of the wallboard were reinforced with strips of strong fabric, purchased with the wallboard. To cement the joints plastic paint was used. First, the joint was "buttered" with a thick



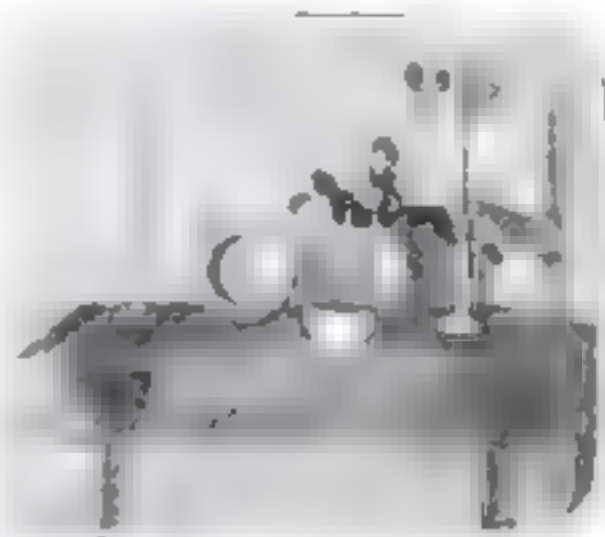
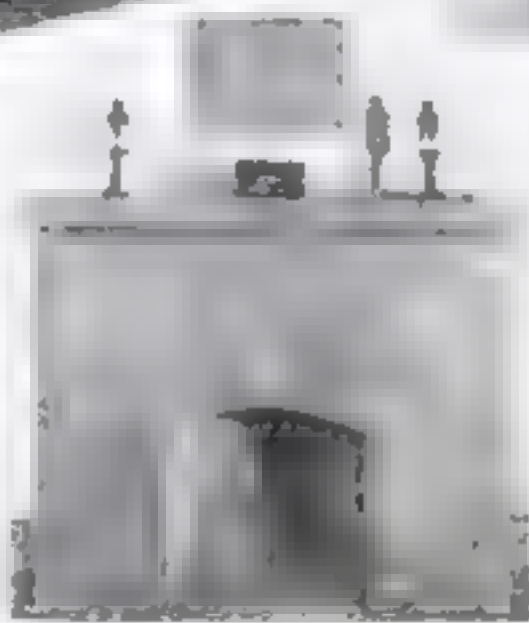
Touching up the keyholes of the treasure chest with black. The lock plates, hinges and straps are of plastic paint.

How we accomplished it I told you in an article in the January issue. Briefly, we decorated the walls of our living room in Spanish texture, the walls of our dining room in Italian style, the ceilings of both in a monastic finish, and the kitchen in a Colonial stipple.

Now, to do all this we used "plastic paint," a material in white powder form, that is bought at the paint store. It is mixed with water, first. Then color is added, either mineral pigment or good oil color, until the desired shade is reached. A large brush, such as a Dutch cake-mixing brush, is used to apply the plastic paint on the walls. While the plastic paint still is "tacky," the rough texture is developed. The back of a kitchen spoon was used to develop the Spanish texture. The Italian texture was developed by leaving the

A fireplace of wood wallboard and plastic paint. The small chest on the mantel and decorative panels above were stenciled with plastic paint.

this page. One would hardly attempt to build a fire in it, because it has no chimney. But it does add materially to the appearance of our living room, and it was more than simple to make.



Glass pottery and wooden objects with plastic paint ornamentation. The candlesticks and bowl are blue, the stenciled London dish is silver, the vase is bronze.

mixture of plastic paint. Then the fabric was pressed lightly along the joint. Next a semirigid putty knife was drawn down the joint with sufficient pressure to force the plastic paint up through the mesh in the fabric. Nail heads then were "spotted" with plastic paint. After the whole had dried, the joints and nailheads were lightly sandpapered.

The fireplace then was ready for decoration. The plastic paint was mixed in the usual way, applied over all surfaces and stippled with a stripping brush. A draftsman's triangle was dragged lightly down the surface to flatten some of the stipples. Keystone, cornerstones and — (continued on page 78)

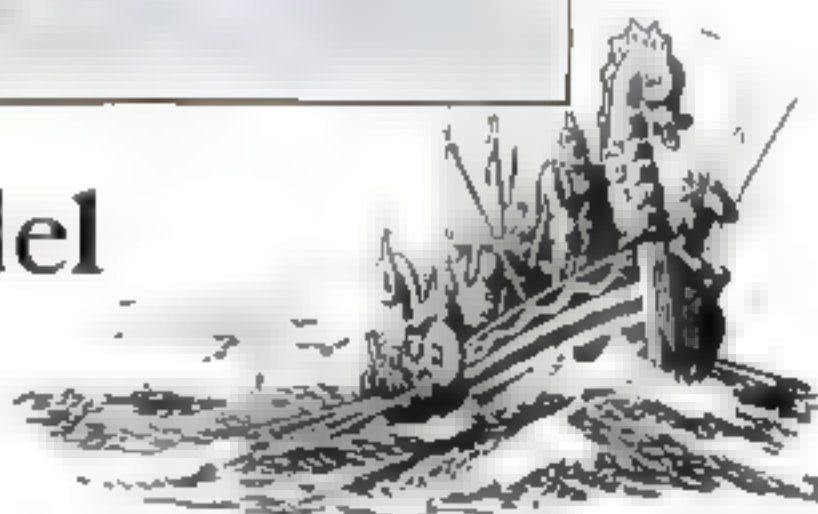
Simplest of all our historic ship models a brilliant and charming decoration may be finished in brilliant colors



Blueprints with full size details of all parts are available for this romantic model, which requires little technical skill to construct

Here Is a Ship Model All Can Build

This Colorful Viking Vessel Is Easy to Make and Is Inexpensive—The Materials Cost Two Dollars or Less



Gothmund spake:

*Swift beak he hard by the land
(Mast-rig hark and mighty yards
Wealth of shields and well planned oars)
The king's fair boat the Viking's haughty;
Fifteen hands in land have fared
But out in Sogn are seven thousand.*

*At anchor lying off Gnipalund
Are five beaks black all filled with gold;
There wait most of the foemen's men,
Nor will Helgi long the battle delay.*

—EDDIC POEM

THE time is some eleven hundred years ago and the scene the rich-carved ancestral hall of Yarn on the shores of Varmland in Norway.

Yarn is growing old. He is rich in everything but sons. His hall is replete with gold, fine fabrics and great treasure of other lands, but his odal is small.

Therefore on this day he gives one of his skutas or dragon ships to his son Lief, telling him to go forth and carve fame and fortune for himself.

Lief, eager for the word like a mettled stallion, gathers around him seventy of the young men clamorous to follow him in

By CAPT. E. A. McCANN

Viking voyages of adventure, discovery and acquisition—to visit friendly ports, hostile countries or unknown lands—to return with gold and wives.

Lief's ship was a war vessel, distinguishable from a merchant craft by her longer lines and ornamentation. She was called variously a skuta, a long ship, a dragon ship, or a long serpent. Her extreme length was 79 ft., the breadth 16 1/2 ft., and the displacement or weight with fittings about 20 tons.

She was slim, but very sturdy and seaworthy. Her object was, with oars and sail, to strike swiftly and hard and to withstand the knocks of an enemy or the battering of the fierce northern gales. His ship was not only useful it was exceedingly decorative, with its carvings and its black and gold color scheme.

Unfortunately, we cannot ourselves go visiting and raiding with Lief, but from authentic data available we can build a model of such a vessel as he used. Those who care to follow carefully the instructions given here can make a dragon ship model without much difficulty and with

little or no expense. Even if all the materials and paints are purchased, their cost should be well within two dollars.

The main dimensions and details of the long-ship or war vessel here described are based on the actual Viking ship which was discovered in 1880 lying in a tumulus, or grave mound, at Gokstad, Norway. This ship is preserved at the University Museum, Christiania. Some details of our model are from a merchant ship found at Osberg and others from the Nydam ship, as well as from the Bayeux tapestry and the Eddic Sagas.

IT IS proposed, however, to simplify the construction, so that, while retaining the correct dimensions and appearance, any reasonably handy person can make the model from easily obtainable materials with such tools as are to be had almost anywhere.

To make the building of the model still easier, two blueprints have been prepared with full size drawings of all the parts and a complete list of materials. These you can obtain by sending 50 cents to the Blueprint Service Department of POPULAR SCIENCE MONTHLY for Blue-

prints Nos. 61 and 62 (see page 69).

Now to work! Instead of laying a keel and on it erecting stem, sternpost and ribs and to these building up the sides, plank by plank, which is tedious and difficult work, we take a piece of $\frac{3}{4}$ -in. three-ply wood 20 $\frac{1}{4}$ in. long by 6 in. wide and from it cut our keel, stem and stern in one piece. Thus we shall call the center piece. It is shown on page 88 and is indicated by the heavy outline on blueprint No. 61.

Those who have not a fretsaw will be well advised to buy one, as it will be handy all through the work. It should have at least a 12-in. bow and may be purchased at any hardware store, with blades, for about a dollar. However, this and the other pieces can be cut with a much cheaper and smaller coping saw.

BEFORE we go any further, it will be noted that the centerpiece extends well into the body of the vessel at the bow and stern; these two portions lie under the fore and after decks, which are built up solid. Those who prefer and have the skill may cut away these corners of the centerpiece to an even curve and later build up the bow and stern lockers and decks; indeed, this method is rather better, but is more trouble. If you do this, the corresponding corners will also have to be cut away from the side blocks, which are to be described next, leaving the boat hollow from end to end. Retain sufficient wood at the ends for gluing and nailing.

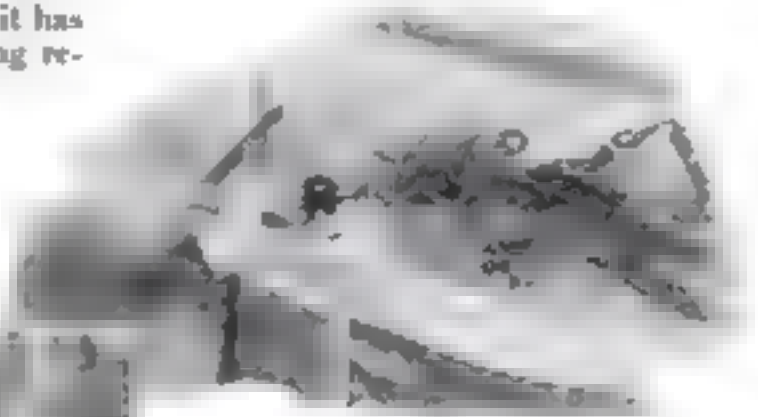
Next to be made are the two side blocks, which form the body of the hull. Each piece is designed to be made from a piece of $\frac{3}{4}$ -in. pine or other soft wood glued to a piece $1\frac{1}{2}$ in. thick. These thicknesses are easily obtainable from any lumber

easier to see just where one is laying the plan. Then, after the tracing has been pinned down to the wood in several places, the carbon paper is slipped between it and the wood.

The waste wood now should be cut away to these lines until the block will be accurately on the blueprint or plan. The blueprint shows the starboard (right-hand) side; the other will, of course, be in reverse. There is a slight difference between the bow and stern ends. Here again the tracing is handy because it has only to be turned over for marking reverse sides.

On the top edge of the blocks mark the outline that is equivalent to a deck plan. With saw, chisel and spokeshave, cut away the waste to

On the amidship or flat side mark the sheer line; this is the curve which makes the ship higher at the bow and stern than elsewhere. Cut to this line, testing occasionally with the try square so that you do not get lower on the outside than the inside. A saw cut or two down to the mark will help in digging out this curve. Note that the stern is a little higher than the bow. The spokeshave is the best tool



How to use cardboard templates for testing the shape of the side blocks of the hull

for this work. Lacking a spokeshave, one can make a good, sharp jackknife serve for this and most other tasks.

Now lay the blocks on the blueprint or your own full size drawing and mark on them the construction lines I to VII. Carry these lines carefully right around the blocks. From the body plan given on Blueprint No. 61 or the diagrams shown within squares on page 88, make a series of thin cardboard templates. Mark on each the corresponding number.

Grip a block by one end, bottom up, in the vise, or with the flat amidship side face down on the table and proceed to shave away the outside until the templates fit to it, as in the upper illustration on this page. Start in the middle and do not attempt to bring the block down to the templates, at their position, one at a time, but shave along the whole length so that they fit almost simultaneously, thus preserving the long flowing lines with no sudden hills or hollows. Leave enough stock on for sandpapering the surface smooth.

A SMALL wooden spokeshave (blade about $1\frac{1}{4}$ in.) is the handiest for this work, but it can be done with a small plane, or even with a jackknife. Note when cutting that you hold the templates at a right angle to the hull end at its corresponding construction station (I to VII) and with the keel and deck marks coinciding with the actual keel and deck lines. Be sure that you do not cut away anything more from those two lines, which you previously marked and cut so carefully.

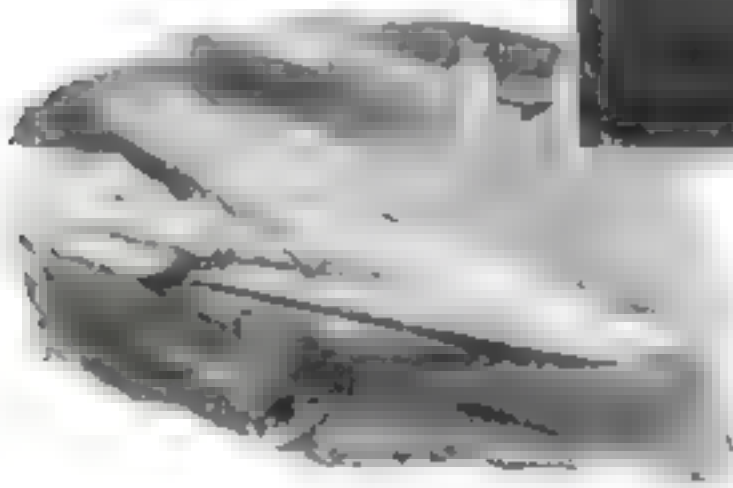
These pieces can be roughly hollowed more readily before they are glued to the centerpiece than after. Therefore, $\frac{3}{4}$ in. from the curved edges, along the top and the flat side, make a pencil mark. Saw down (as suggested in the small illustration on page 88) (Continued on page 88)



Captain McCann shows how to finish hollowing the hull with a gouge after the centerpiece and the side blocks have been glued securely together

These lines, but do not cut too fine at the extreme ends, because if the points are bruised and broken, pieces will have to be built in to renew them.

Holding the blocks of wood while working on them is no trouble if one has a bench vise. One should certainly have a vise for ease in doing most carpentry jobs. If, however, one has no regular bench, it is worth while to buy a small iron vise which may be clamped on to a table. In the absence of a vise of any kind, I suggest cutting a V-shaped notch in a piece of plank and fastening it on to the table with a C-clamp or hand screw to act as a stop. Cut a wedge to fill half the notch, then either end of a side block may be held firm by pushing it and the wedge side by side into the notch.



The planking is represented by scoring lines with a jackknife and cutting long, shallow grooves with a chisel

dealer. One solid piece or layers of other thicknesses will serve equally well, provided their dimensions are at least 2 $\frac{1}{4}$ by 2 by 10 in. each.

On one side of each block mark the profiles for cutting. These and other lines may be transferred to the wood by making full size drawings from those on page 88, or, more easily, from the blueprints, where everything is given in full scale. You can trace the outlines through a piece of typewriting carbon tissue, but I prefer to trace them first on to tracing paper because with this it is so much

You Can Build This Armchair

*A Cross-Legged Seat That Is Remarkably Comfortable
Inexpensive to Make, but of Rich and Costly Appearance*

By CHARLES A. KING

"WHEN we get tired of auto tripping I do hope we can have a camp or bungalow as well planned and furnished as this!" exclaimed Mildred. "I have never sat in a chair that seemed quite as comfortable."

She leaned back contentedly in the roomy folding armchair and smiled at Helen and Val.

"I am glad you like it," responded Val. "For I had considerable difficulty in persuading Helen that we wanted just that kind of chair. Now we both feel that we could have found nothing more satisfactory."

"I don't think you could," agreed Jimmie Mildred's husband. "They are seldom appreciated, yet it seems to me that no chair is quite so easy to drop into."

"I think," laughed Val, "that the man who invented the chair is a public benefactor and hope that he has had no trouble in collecting adequate remuneration."

"WELL," rejoined Jimmie, who was an interior decorator, "if he had not collected his just dues a couple of thousand years ago, I think he would have trouble in establishing his claim today, for these chairs are direct descendants of the Roman chairs which were common before the days of the Caesars."

"I supposed they were a modern product," said Val. "What is the connection between the Roman chair and these?"

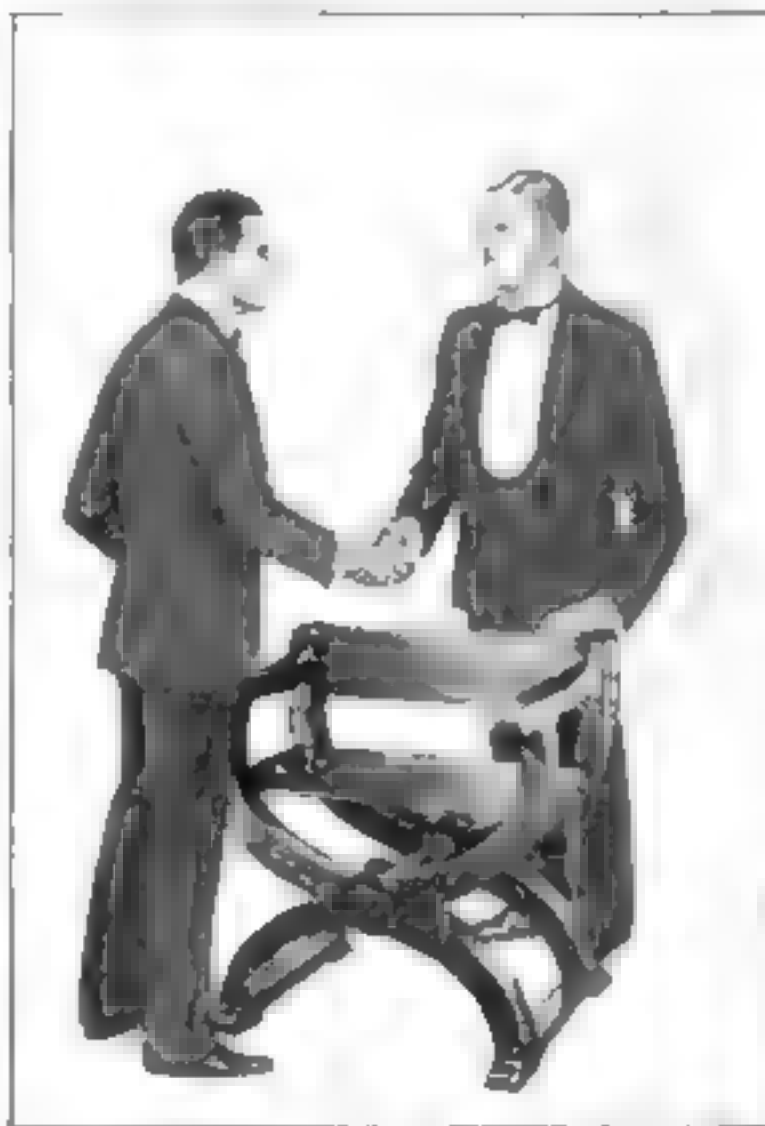
"You had better not get Jimmie started on the evolution of furniture," warned Mildred, "for that is his particular hobby and he will talk on it all night if he has the least encouragement."

"Good!" ejaculated Helen and Val in concert.

"That will be just fine," Helen added, "for we are buying pieces as we happen to find them for our new house at Braintree. Now, Jimmie, we want you to tell us just what a Roman chair is and the process of its evolution to the folding chair."

"Well," Jimmie replied, "if elegance of design and workmanship were the basis of evolution I should say it was a case of devotion instead. As compared with

this camp chair (A, on this page), the Roman chair (B, page 90) was made of a number of pieces of wood from one and a half to two inches thick, shaped to a compound or reverse curve and laid together with an iron rod. It was not particularly a forcing chair, but its form easily suggested that adaptation. It was a heavy



Cross-legged armchair with Spanish leather seat and back, which Val planned to make. The working drawings are given on page 91.



This type of folding camp chair, referred to as A in the text, is a direct descendant of chair B on page 90.

and clumsy piece of furniture, which was perhaps the reason why, in its evolution to the Italian Renaissance, its shape (C) was changed in the direction of lightness and economy of material. Then it became necessary to make a seat instead of merely shaping the legs to fit the body or to receive a cushion.

"The type was common in Italy during the middle ages. It is often called a Dante or Savonarola chair. In one form or another the chair has appeared in nearly every European nation whose cabinet makers were skilful enough to produce them. We find modifications of the Roman design in old Spanish furniture (D) and in Flemish, German and English (E), more especially during the Tudor period of the sixteenth century."

"EXCEPTING the Italian pieces most of these modifications were of four heavy legs, either rigid, folding or semi-folding. The type received little attention during the seventeenth, eighteenth and early nineteenth centuries, which saw the inception of our modern furniture. This explains why you do not see the type in our early American pieces. Designers and cabinetmakers gave their attention to styles favored by reigning houses or the styles of designers and makers who for the time had the public fancy, Chippendale, Heppelwhite, Sheraton, Phyle and others. They designed no furniture based upon the cross-legged motive, though in some cases it was suggested."

"It has remained for modern furniture designers to rehabilitate the cross-legged design in making chairs. They are often used in fine homes, especially of the California and Florida types, where the rough plastered or plastic paint walls form an ideal background for massive furniture."

"Today we seek for any type which may be adapted to modern needs. For example, look at this."

Here Jimmie reached into his coat pocket and produced a sketch-book, his inseparable companion. In it were many original sketches and memoranda of furniture, including the drawings for the chairs marked F and G (pages 90 and 91).

"While the cross legs of this chair (F)," Jimmie explained, "are halved in the center and fastened together rigidly, the method of fastening the rounds with bolts and screws."

(Continued on page 90)

What's wrong with this Picture?



John and Mary have started on a day's picnic. But with the hard luck that has followed John he has just got nicely started when a front tire goes flat.

MOST of the readers of Popular Science Monthly will know what he is doing wrong. The picture shows him wrestling with his punctured tube—trying to patch it with a piece of rubber and some cement. It will take him half an hour or so—and when he does get his tire back on the wheel and the weight of the car on it he may discover, like thousands of others, that his patch doesn't hold air and it may be necessary for him to go through the same sweaty performance again within a few miles.

The readers of Popular Science Monthly have helped John and Mary in many of their difficulties. If they were there they would tell John to stop in the next town at any place where auto supplies are sold and get a Shaler 5-Minute Vulcanizer Outfit so that the next time he had tire trouble he could make a *permanent* repair in a few minutes that would last as long as his tube.

Complete Outfit Costs Only \$1.50

Any tire repair man will tell you that to make puncture repairs last you must **VULCANIZE** with **HEAT**. That's why more than four million motorists use the Shaler 5-Minute Vulcanizer. It's the quickest and easiest way to fix punctures and make repairs permanent under conditions that would soon loosen any cemented patch—for instance in Balloon Tires. The Outfit includes Vulcanizer and 12 Patches—Patch and Heat Units—ready to use—only \$1.50 (a little more in Far West and Canada).

THE SHALER COMPANY, Waupun, Wis., U. S. A.



PRIZES FOR BEST ANSWERS

What's wrong in the picture beside the fact that John is not using a Shaler 5-Minute Vulcanizer?

To the fifty people sending in the best answers we will give **FREE** a complete \$1.50 Shaler 5-Minute Vulcanizer outfit with patches.

Completeness, correctness and neatness are the things on which winners will be judged.

Contest closes June 1, 1927.

Address

THE SHALER CO.
Waupun, Wisconsin

What My Shop Has Taught Me

How to Keep Bench and Tools in Order and Run a Lathe with a Salvaged Motor Hints on Homemade Furniture

By HAROLD P. STRAND

SO MANY beautiful, useful articles can be made with a few tools, from a rough, shapeless piece of wood, that I just can't understand men who profess no interest in building or creating things with their hands. They miss a great deal in life.

My own desire to build things began early. As a boy of fifteen years, I undertook to construct a two-car garage for a friend. While I had a little help in the framing, the rest of the work I accomplished all alone. I shingled the roof, clapboarded the sides, hung the doors and windows and laid a 2-in. plank floor. Even today when I happen to pass the property with a companion, I take pride in saying:

"See that garage over there? Well, I built it myself when I was a kid in grammar school."

After the garage was completed, I cleaned away a corner of the cellar at home so I could put up a bench and have a little workshop. From that day to the



Mr. Strand in his workshop at Malden, Mass. He is rubbing down an old desk which has just been restored. Note the bench, tool rack and lathe.

To derive the utmost pleasure from my hobby, I have found it essential to keep an orderly shop. It is no fun to go to your bench for an evening's work with your mind full of ideas and then to find a conglomeration of papers, shavings and tools lying about. The job of cleaning up, sorting out scattered tools and otherwise washing previous time is to me such a discouraging beginning that I lose my eagerness and rest. So I think it is a good plan to spend a little time picking up after the evening's work—even if you have to quit work a little earlier. Give the next day a clean slate and an unhampered start.

THE place for the tools more commonly used is in a neatly arranged rack at the back of the bench, where each has its own stall. Then a vacant place tells of a mislaid or lost tool. The tool chest is all right for tools kept to meet unusual needs and for small odds and ends, but much time can be wasted by the man who keeps all his working implements tucked away in a chest.

To do good work, keep your cutting tools sharp with wheel and stone. Sharpen your saws or have them sharpened when they need it for otherwise they cannot do accurate work. The saws I have are the pride of my workshop. One of my saws belonged to my grandfather in England and it holds its edge and cuts beautifully.

I find it necessary to have a pair of each of these saws: Rip saw, coarse and fine crosscut saws, fine tooth back saw, compass saw and coping saw. The reason I have two of each is because on particular work I like to "feel" the saw cut and use the one that appeals to me for each operation. Two saws, even

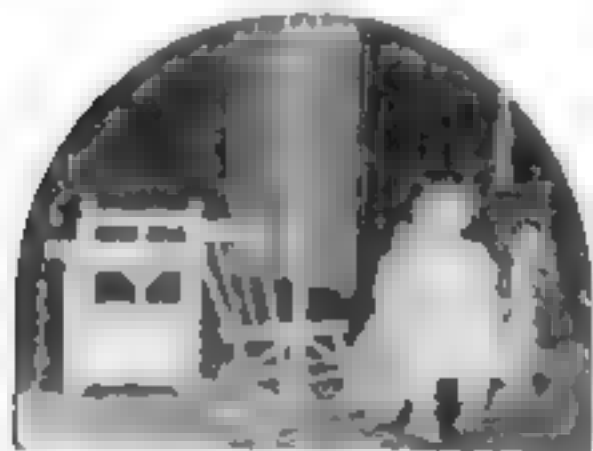
of the same size and tooth, rarely "handle" the same, at least that is the way it seems to me. What a thrill one can get from the feeling of a sharp, well-set saw cutting its way with little effort through a solid, dry plank!

A saw vice, a three-cornered file and a saw set are indispensable. The saws themselves are kept hanging up when not in use, so nothing can cross the teeth and ruin the keen points.

It is a good plan to rub a little oil on them once in a while to keep the dampness from rusting them.

The sharpening wheel I used for years for grinding plane blades, chisels and other tools was one I made of bicycle parts. The crank hanger was the main drive, with the regular chain driving a sprocket on an old rear wheel, the rim of which made an excellent pulley. This received a belt, making the final drive to the grinding wheel shaft. The whole assembly was arranged in a hardwood frame with a seat for use while pedaling.

Recently when the motor on our washing machine burned out, I bought a new one for the washer and then set out to rewind the old one for use in my shop. I charted the wire as I took it off and finally made a successful job of the feed winding. This motor was a welcome addition. I have belted it to a wood turning lathe which formerly was operated by foot. (Continued on page 75)



Two toy rockers, a clothes rack and a chair made for the author's baby daughter.

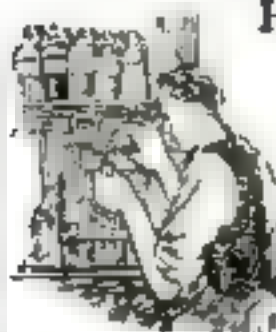
present my hobby has been my workshop.

I cannot begin to list all that has been accomplished or tabulate the amount of money that has been saved through this hobby. In our house, as in every other house, furniture has become damaged from time to time: a chair has required gluing up, or a table leg has suffered a blow. Perhaps the tea wagon has been left in front of a drafty window and the varnish become so checked that the piece must be refinished.

How many times cupboard doors have been found that needed planing? And countless screws and nails have been wanted here and there. Then there have always been new things needed that could be made at much less cost than their commercial equivalents could be bought.



The radio cabinet and piano lamp above are of solid mahogany. A handmade cedar chest is shown at the left.



Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

PHOTOGRAPHS may be tinted or stained simply by immersing the prints in various salt solutions. In this process the main consideration is absolute cleanliness. All possible sources of pollution must be removed and the prints must be washed thoroughly in plenty of water after being removed from the bath.

As a rule the photos must be bleached before they will take the stain, especially those types of stains which can be made at home. A bleach may be made from 1 grain cupric chloride in 100 cc. of water (or a teaspoonful of the salt in a glass of water). As soon as the image has faded almost completely from the print, it is washed in water and placed in the tinting solution or bath.

If cupric chloride is not at hand, potassium bichromate may be used. Make a saturated

solution of the salt in water. To one part of this solution add four parts of water and two or three drops of hydrochloric acid for each glassful of the mixture. This is a rapid bleach, but it has one disadvantage in that the prints are, at times, tinged a slight yellow.



Mixing a solution for staining photographs

After bleaching, wash the print in water, allowing it to remain for a sufficiently long time to remove the salts.

A deep coppery tint is obtained on all places that were black, while the whites remain perfectly white, when a copper bleached print is dried in sunlight or when dried and then exposed to sunlight. The shades produced are permanent.

To obtain a slightly browner tint, the bleached and washed print is bathed in a solution of 1 gram ferrous sulphate and 10 drops of dilute sulphuric acid in 100 cc. of water, or a half teaspoonful of the salt is placed in a glass of water and the acid just mentioned is added. Leave the print in the bath about five minutes, then wash, dry and expose to sunlight.

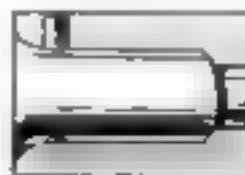
A pleasing sepia tone is obtained in a similar way by using a bath made by dissolving one gram of potassium oxalate in 245 cc. of water, or 1 heaped teaspoon of the salt in a glass of water.

A very dark reddish brown verging towards black is obtained by bleaching, washing and placing the print in the ferrous sulphate mentioned above, then washing and transferring it to the oxalate bath.

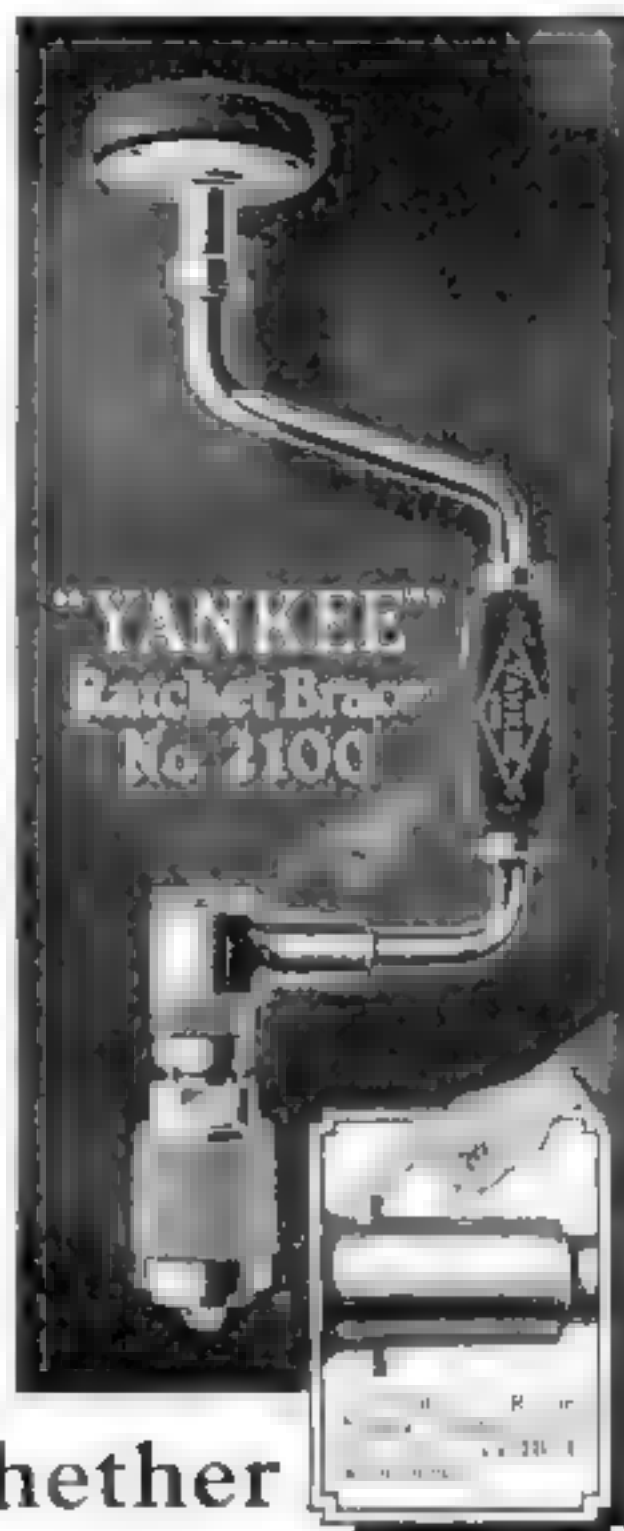
All these processes stain only the black or shaded portions. The whites are not influenced by the staining action. Old photos can be used just as well as new.



Shifter position down for right-hand ratchet



Shifter position up for left-hand ratchet



a glance shows whether on ratchet or rigid

WITH the "Yankee" Bit-brace you do not have to try the tool this way and that to find out which way the ratchet is set.

A glance tells the story: with *ratchet shifter* centered, the brace is rigid. When shifter is down, the brace is on right-hand ratchet; when up, left-hand ratchet.

You change the ratchet adjustment at a fingertouch—and you see what you are doing!

The "Yankee" Ratchet is famous for its easy action. Smooth, silent, powerful! Chuck is quick centering, accurate and will not loosen in work. Hard Rubber Handles do not warp, shrink, crack nor bind.

Try the "Yankee" Brace at your hardware dealer's. You will see the economy of owning the finest tool of its kind. Ask him to show you the new "Yankee" Bit Extension.

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Plain Screw-drivers
Automatic Push Drills
Automatic Feed Bench Drills
Ratchet Tap Wrenches
Vices—Removable Base
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"YANKEE" TOOLS

Make Better Mechanics



Easy Ways to Do Recessing Jobs

Chuckling Work Quickly in a Turret Lathe—Using a "Pull" Cut to Avoid Chattering—Hints on Facing

By ALBERT A. DOWD

THESE castings have to be recessed," said the machine shop foreman one morning to young Harvey Smith. "The original blueprint showed a straight hole, so we reamed them all to size, and now the engineering department gives me a blueprint like this (A in Fig. 1) and tells me to recess fifty of these pieces. You'll have to hold them in a four-jaw independent chuck or set them on a short plug on a faceplate so the inside hole will run true. See what you can do to hustle the job out."

The foreman walked away and Harvey looked doubtfully at the blueprint. It called for a recess $\frac{1}{4}$ in. deep and $1\frac{1}{2}$ long, inside the previously reamed hole. Then he picked up one of the pieces, which were of cast iron, unfinished on the outside and faced only on one end. As he stood there thinking it over, Mr. Grimes, the efficiency engineer, came along.

"Anything of interest this morning?" he asked cheerfully.

"Not much," the young machinist replied, "only the foreman just gave me the job of recessing these castings that have already been bored and reamed. I've got to get the recess somewhere near concentric with the other hole."

"HOW are you going to do that?" inquired Grimes.

"Oh, Tom said to put a plug in a faceplate or hold it in a four-jaw chuck. He don't seem to care how I do the job. I think I will use the four-jaw chuck on the lathe here, put a



plug in the hole and indicate it and then bore out the recess with a tool like this."

Harvey pointed to a tool that was lying on the bench. It was similar to B, Fig. 1.

"I would have to turn up a plug of the right size," he continued, "and fit it to a sixteen-inch faceplate and then rig up some clamps to hold the work if I do it the other way, and it would take me two or three hours to get started."

"Why don't you do the job on that idle turret lathe over there?" suggested Grimes. "There is a four-jaw chuck already on it and I can tell you a faster way to do the work than either of those you have mentioned."

The engineer made a quick explanatory sketch (Fig. 2).

"See—just get a bar B, one and a half inches in diameter, and put it in holder C on the turret. Slip your casting A on to the bar and move the turret up until the work is up against the face of the chuck. Bring up your chuck jaws independently to grip the work and then pull back the turret out of the way.

You can easily mount a recessing tool at D and then go right ahead and machine the recess."

"That's a great scheme, Mr. Grimes," exclaimed Harvey enthusiastically.

"Yes, and you can apply the same idea to other jobs now and then when you have an opportunity."

"What about recessing operations?" asked Harvey. "Is there anything particular about the way the

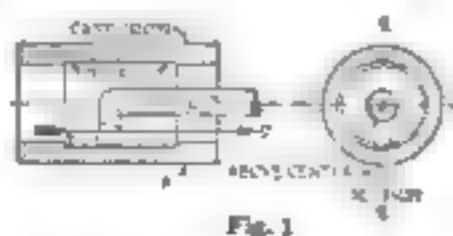
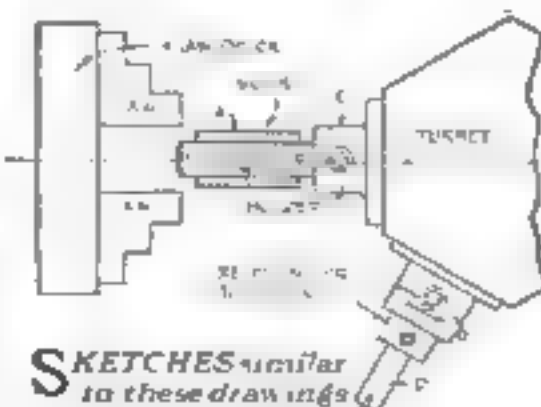


Fig. 1



SKETCHES similar to these drawings were made by Grimes for Harvey's benefit

Fig. 2

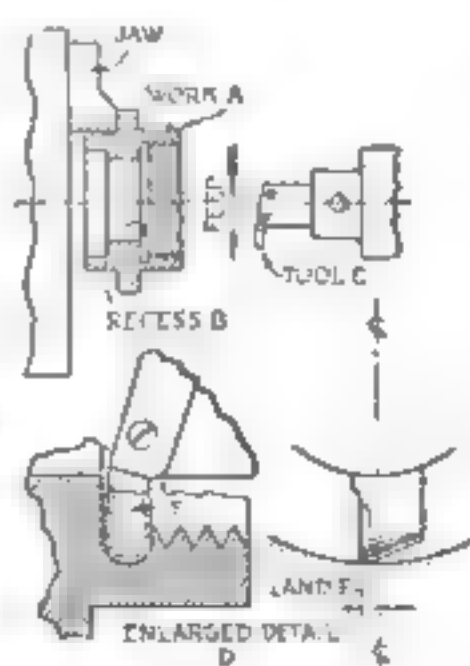


Fig. 3

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, pages 98 to 103.



"As the twig is bent—"

If you've "been through the mill," you know what it means to a young fellow to start with the right tools. There isn't anything that'll help him more than a set of fine precision tools—Starrett's. Give him a Starrett Apprentice Set, No. 900.

If you're just beginning, here are the tools you need. It's a kit that you'll be proud to show any man, because they're all Starrett's, the tools that two generations of American craftsmen have accepted as the standard for quality and accuracy.

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Use Starrett Tools

Love Sends Convert to Pipe-smoking on Tobacco Hunt

Of course a young man in love will do anything to win favor in the eyes of his lady fair. And pipe-smoking seems to be one of the credentials that admit young male America into the graces of the fair sex.

But while smoking a pipe seems to solve the feminine problem, finding the right tobacco evidently is the male problem.

Probably that is what prompts such letters as this:

New York, N. Y.
June 30, 1926

Larus & Bro. Co.
Richmond, Va.
Gentlemen:

I started smoking on cigarettes, but after seeing a young lady in whom men who smoked pipes took a greater charm, I promptly converted to me.

Then my agony began. I tried one brand of tobacco after another, always making out the theory that the one you paid for tobacco, the better it would be.

Then came the day I tried Edgeworth. It was at a low price. I had run short of the certain brand I was smoking, and a casual acquaintance offered me a package.

Imagine my delight when after the first few puffs, I did not feel the old familiar lute. I huffed me, placing the dough in a room, and oh, boy! it was sweet right down to the bottom.

Nothing has separated me from my pipe, or my pipe from Edgeworth since then.

Yours very truly,

(Signed) David Friedman, Jr.



Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it for it never changes in quality.

Write your name and address to Larus & Brother Co., 10-P S. 21st St., Richmond, Va.

We'll be grateful for the name

and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all pipe smokers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidor holding a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

⚡ On your radio—tune in on WFFA Richmond, Va., the Edgeworth Station. We're length 256 meters.

New Uses for Plastic Paints

(Continued from page 69)

plaque (the rectangle with the lion on it; you can see it if you look closely) were smoothed down with the triangle and the whole was allowed to dry.

The next step was the application of the lion in the plaque and the fleur-de-lis in the two top cornerstones and out near the edges of the fireplace on a line with the plaque. These were made with uncolored plastic paint applied through stencils bought at the paint store. Then the joints were scored to produce the effect of stones with a common file bent at right angles to the tang or handle end. A yardstick and ruler were used to keep the scoring straight.

Next day the whole was sandpapered lightly with No. 1½ sandpaper to remove rough edges. A mix of a half pound each of rottenstone and size was made and applied with a Dutch calcimine brush. As the mix was applied with the right hand, it was wiped off with a soft cloth held in the left. Thus it stayed in the depressions and joints but was wiped off the high spots, and gave the whole the rich finish of old stones. This completed the job, all but coloring the lion in the plaque which was done some days later, with raw umber (artists' oil color), wiped partly off.

Now to return to the decoration of the other three rooms and the hallway:

The furniture in the bedroom that Eleanor and I share was given to us by Eleanor's mother, who had it as a wedding gift from her mother. So it is quite old. The design of all the pieces is heavy and substantial, more English in character than anything else, so we decided on a rough texture adapted from those found in

English cottages and a shade of about beach sand for the color. Of course, we first made the usual test panel on wall-board.

In this bedroom the walls were covered with wall paper, so we had before us the same job that had confronted us in the dining room. We removed all the old paper, washed the entire surface down with a solution of sal soda and hot

water and then filled such cracks as there were with the cement that is used in the application of plaster wallboard.

Yellow ochre was the color mixed, first with water in a separate pan, and then with the plastic paint. The mix was brushed on to the wall in random sweeps. The English texture was produced with a

4-in. semiflexible putty knife. This was drawn over the wet paint in such a manner that welts appeared on either side of the knife, the extent of each sweep being about an eighth circle.

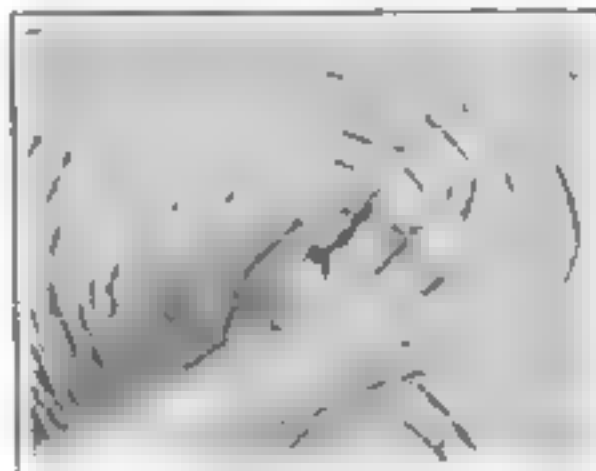
The material for the ceiling was mixed about two shades lighter than that for the walls, for a ceiling of the same shade would have appeared darker than the walls in the finished job. The ceiling texture simply was a brush texture—the paint was brushed on and left as was.

JUNIOR'S room was next. It originally had been decorated with calcimine. For a sturdy up-and-about youngster, Junior has a lot of consideration for walls. They were in virtually perfect condition, and all we had to do to prepare the surface for plastic paint was to wash the calcimine off and let the walls dry thoroughly. We felt that Junior would most appreciate a gay and cheerful color, so we decided on salmon. And we also felt that a novelty texture would interest the young man most, so we chose a finger scroll, which is developed with the tips of the fingers.

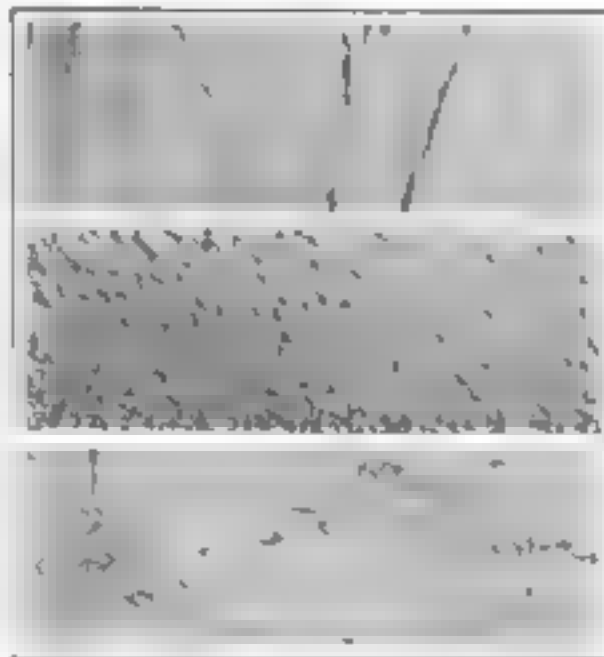
To color our plastic paint we used burnt sienna and yellow ochre in equal proportions. The paint then was brushed on the walls in the usual manner and the scroll texture was produced by drawing the tips of the fingers through the wet material in a wide circular motion. The ceiling was finished in a lighter shade and in the brush texture. After the walls had thoroughly dried, the few too-large welts that had turned up from under the tips of our fingers were sandpapered.

This left the guest room and entrance hallway. The guest room had wall paper on the wall. This was removed and the walls were treated as they had been in Eleanor's and my

(Continued on page 79)



Many striking effects may be obtained with the fingers, as in this sample scroll texture.



Developing a travertine finish. Greenmap is blown on the paint after it is stippled.

Plastic Paint Decorating

(Continued from page 75)

room. The texture selected was a brush finish and gray was the color chosen.

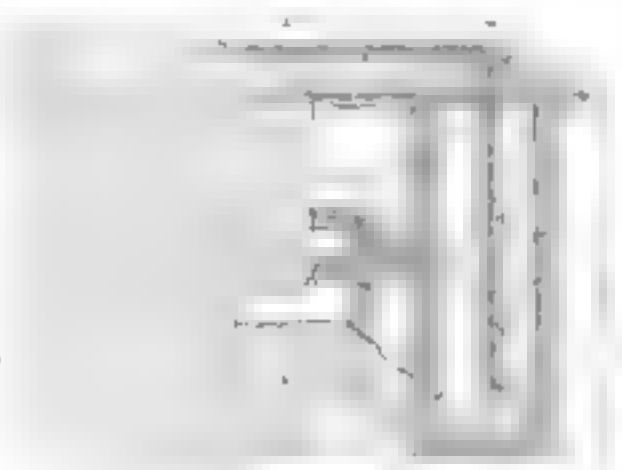
To get our gray color, dry Swedish black was mixed and added to the white plastic paint. I have since learned that dry lampblack can be used if it is first mixed with alcohol to cut the grease.

A plain brush texture was used on the walls and ceiling of this room.

Our entrance hallway was the next point of attack. We selected a finish of imitation travertine marble.

Now this effect really is simple to produce. Every step in its development is shown in one of the illustrations except the blowing in of the greenspar—a sand from Florida's beaches.

First, the plastic paint was tinted with raw sienna to approximately a deep cream. It then was applied to the walls and stippled with a stippling brush. Next,



TOP: IF MARBLE EXTENDS BEYOND BASE, ARE LINES

Now the fireplace framework is built and covered with wallboard ready for finishing.

the greenspar was blown in simply by placing the powdered material on a sheet of paper, holding the paper about a foot from the wall and blowing the greenspar off the paper and on to the wall. A draftsman's triangle—the one used in making the fireplace—was drawn across the surface in such a way as to smooth down most of the stippling, the pits that remained completed the effect of true travertine stone. After the wall had thoroughly hardened, it was sandpapered with No. 1½ sandpaper and the stones were marked off as on the fireplace. A coat of size completed the job.

This effect was carried all the way up to the ceiling, which was finished in a brush texture and a cream color.

Thus, we completed the redecoration of our house. But we were by no means through with plastic paint!

The first idea I had was derived from an illustration in the picture section of our Sunday newspaper. The illustration was from some movie and showed a pirate on a sea beach, standing beside an old brass-bound chest, evidently a treasure chest. The chest was picturesque and I knew that one like it would be a good ornament for our living room or hall.

I needn't go into detail about the actual making of the box, but after it was made, it was necessary to treat all the joints with the same reinforcement used in building the fireplace.

The next thing (Continued on page 81)

"I Wonder How He Knows So Much!"

How many men do you know who surprise you by the wealth of their general knowledge and information on all sorts of subjects—history, biography, travel, politics, business, sports, and a thousand other things? If you were to inquire, you would find that these men make a habit of consulting an up-to-date Encyclopaedia. Here they have access to the knowledge of centuries—concise and plainly stated, easy to grasp and remember. Through the constant use of the Encyclopaedia they are familiar with all the things that people talk about.

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Like a fairy wand, your brush of Rogers Brushing Lacquer works magical transformations. Shabby things become works of art before your eyes

Irksome preparatory work is gone. Experience is unnecessary. Merely dip the brush deep into the rich "Rogers" color. Apply it freely right over the old finish. "Rogers" covers perfectly. Flows together in a smooth, lustrous coating. And then it

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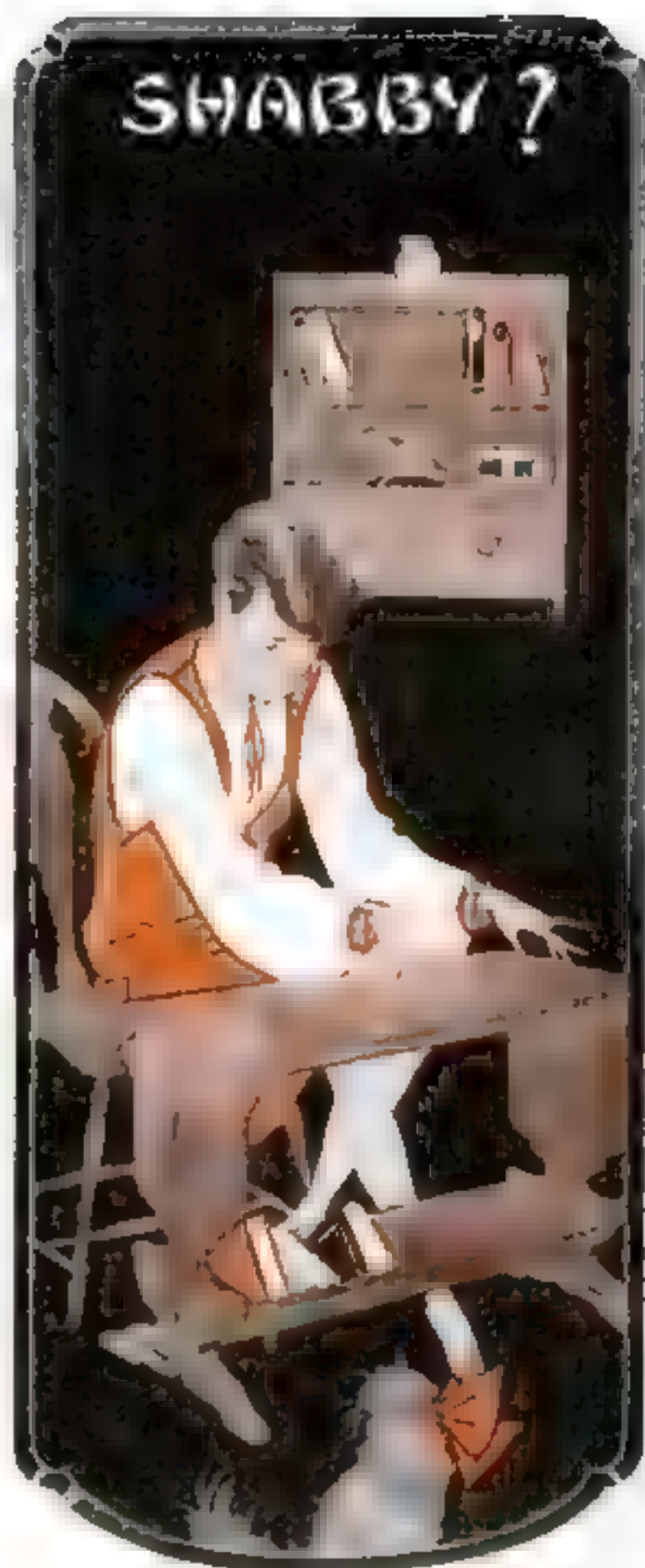
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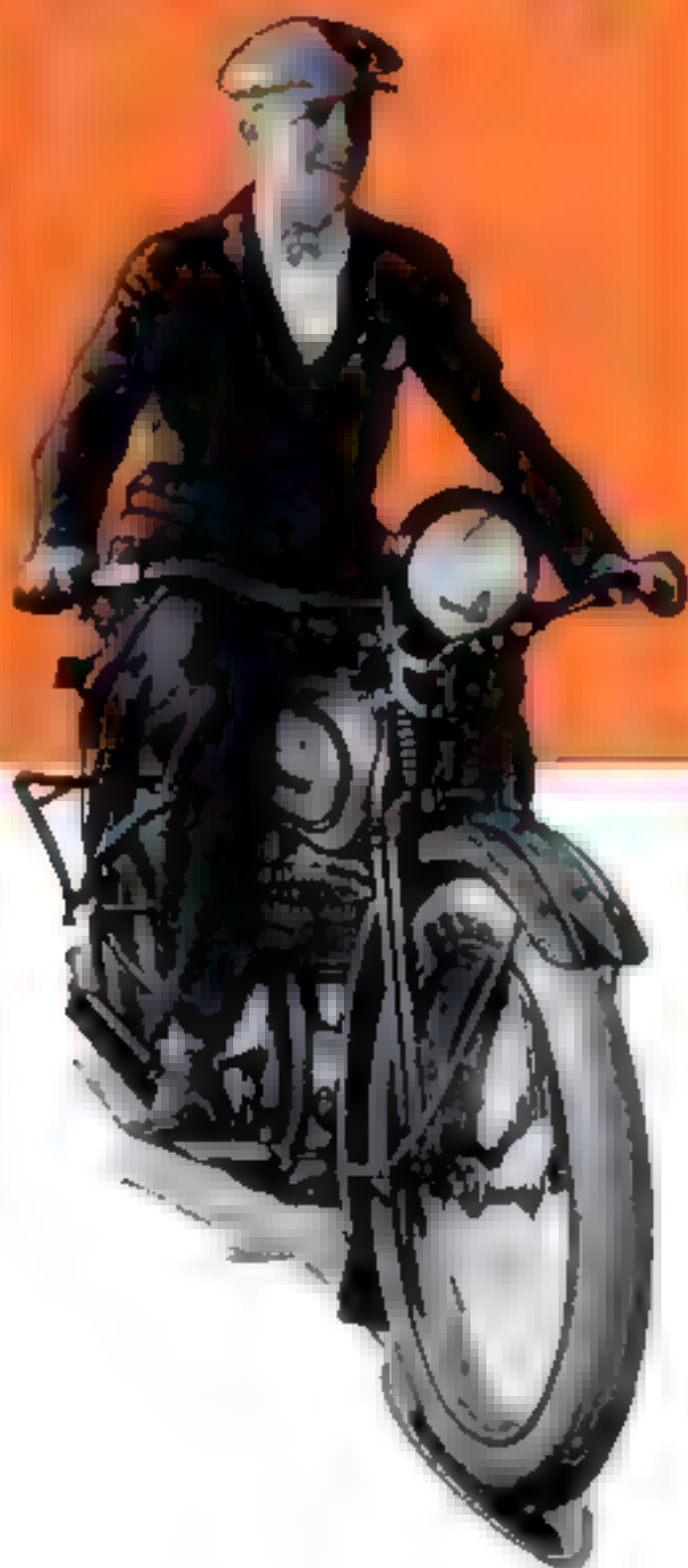
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The
HARLEY-DAVIDSON
[New-Type
Motorcycle.] *Single*

80 miles
per gallon

Plastic Paint Decorating

(Continued from page 78)

we did was to cover the whole box, except the bottom, with a thick coat of uncolored plastic paint. This was streaked and swirled with the brush to reproduce the grain and knots of old wood. After the paint had dried it was sandpapered lightly.

NEXT, stencils were cut in common stencil paper for the hinges, flanges and locks, and the plastic paint was applied through the stencils with a 4-in. semi-flexible putty knife to a thickness of about $\frac{1}{16}$ in. To give these imitation hinges, flanges and locks the appearance of hammered iron, we tapped them at random with the end of a pencil. This method was satisfactory enough, but I am now convinced that a better effect can be obtained with a stippling brush.

To make the corner bands, bottom bands and lid bands, we stuck adhesive tape on the box about 1 in. out from where the bands were to be. This gave us a "deadline" and kept our hands straight. The plastic paint then was applied with a putty knife to a thickness of $\frac{1}{16}$ in. and "hammered" with the end of a pencil. When the bands had dried they were lightly sandpapered and the adhesive tape was pulled off. Brass-headed tacks now were placed in a vise and dented with a hammer, then nailed into the "iron work."

Every pirate chest that is worth its salt has wormholes in it. So we put wormholes in ours—with an ice pick.

TO MAKE the front hinges, a pencil was broken in three parts, each part was dipped in plastic paint and then stuck on the box. When dry, the hinges were sandpapered lightly and scored to complete the hinge appearance.

Next, the whole box was coated with oak stain, which was wiped off lightly with a cloth to produce high lights and shadows. When this was dry the chest was given a coat of clear varnish and while the varnish was still "tacky" the box was dusted with rottenstone, the excess rottenstone being wiped off. The surface now resembled old wood; the next step was to finish the "iron work."

To the flanges and similar parts, a coat of aluminum paint was applied. When this had dried, lampblack was mixed with a small quantity of varnish and applied to the "iron work" and wiped off with a soft cloth. This left the black in the depressions.

The job was now finished but for the handles. Ours were hammered out of a piece of tin with a cold chisel and then treated with aluminum paint and lampblack and varnish, but I wouldn't recommend this method. Handles of many sorts, antique and otherwise, can be purchased, and they will serve as well as those we so laboriously made.

I could continue on and tell you how candlesticks were given an individual finish and texture with plastic paint, how vases and bowls and trays were made, how panels were stenciled and hung as pictures, but I might be robbing you of some of the fun that comes from working out such problems for yourself.



To "Show Me" Fellows

Let us show you that the claims men make
for this unique shaving cream
are true

—Accept, Please, Full 10-Day Tube to Try

GENTLEMEN

When salesmen call on us, we give them a courteous hearing—then ask for samples.

And since it is a poor rule that doesn't work both ways, we sell Palmolive Shaving Cream on that basis. We think you are entitled to a testable sized sample before you try it.

Will you accept one—a full 10-day tube? We'll thank you for the opportunity.

60 years of soap study stand behind this creation. It embodies the expressed desire of 1000 men whose supreme wishes in a shaving cream were asked before we started it. Our whole experience as soap and skin

experts, as the makers of Palmolive Soap, is embodied

5 new advantages

1. Multiplies itself in lather 250 times
2. Softens the beard in one minute
3. Maintains its creamy fullness for 10 minutes on the face
4. Strong bubbles hold the hairs erect for cutting
5. Fine after-effects due to palm and olive oil content

Just send coupon

Your present method may suit you well. But still there may be a better one. This test may mean much to you in comfort. Send the coupon before you forget.

THE PALMOLIVE COMPANY, INC., CHICAGO, ILL.



10 SHAVES FREE

and a can of Palmolive After Shaving Tale



Strop your blades and put the saving away for a rainy day

Perhaps you don't realize how much you spend for blades in a year. Figure it out some day—the total will surprise you.

Stropping will save a big part of it, for stropping not only puts a much keener cutting edge on a blade but keeps it keen indefinitely.

Here are the cold facts from a Certified Public Accountant—

"I shave practically every day, therefore my Twinplex has stropped a blade over four thousand times. If I had used a new blade daily, as I had to before I bought the Twinplex, at 75 cents for 20 blades, I would have paid out at least \$300.00 for blades. But with the Twinplex, a blade always lasts at least a week, and some two and three. I have had fine, smooth shaves, better than the new blade without stropping for less than \$30."



But the saving is only half the story. If you've never used a NEW blade stropped, you've never had a really good shave. Take this opportunity to get one.

Stropped NEW Blade Free

Name your razor and we'll send you, free, a NEW blade stropped on a Twinplex. We would like to show you what real shaving is.

All dealers are authorized to sell you a Twinplex on 30 days trial. If after four weeks of marvelous shaving you are willing to forego the comfort and economy you have enjoyed, give up your Twinplex and get back your money. If you can't find the model you want, write us.

TWINPLEX SALES CO.
1757 Locust Street, Saint Louis
New York Montreal London Chicago

Twinplex

Stroppers

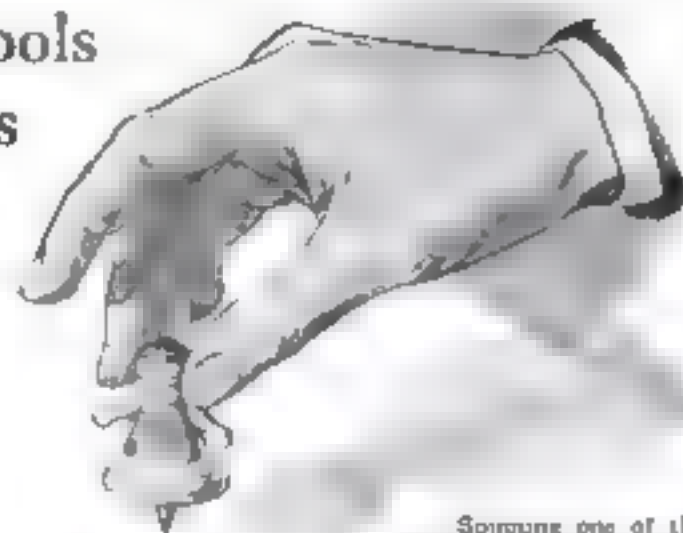
Tops Made of Spools and Clothespins

By F. CLARKE HUGHES

KNOB ends cut from ordinary clothespins and sections from thread spools are the materials necessary for making the tops illustrated. All four types of these quaint little "cornucopias" may be made by combining the same materials in different ways. As many other styles may be constructed as there are spools and clothespins from which to make them. The ones that are low and broad span the best.

The sections of clothespins and spools may be cut with either a knife or a saw. Be careful to have the ends square. When these are glued together, the arms, cap and spindle are added, as suggested in the sketches.

Only clear, bright oil colors, or fine,



Spinning one of the gaily painted tops

brilliant enamels should be used for finishing these little tops. Use pink or flesh tints for the face and arms, black for the hair and spindle, and any pastel shades for the costume. The under surface of the spool is painted white. A set of these tops will be much appreciated by any small child.

Next month—a clothes-pin fly

How to Replace a Flush Electric Switch

By GEORGE A. WILLOUGHBY

After the wires are in place, the new switch is put in place at the outlet box and a terminal screw is provided.



Putting the cover plate on the new switch above, which is of the modern hunter type. The cover matches the woodwork of the room. It replaces the old wood switch shown at the right.



MODERN types of electric switches and cover plates often will improve the appearance and convenience of a lighting installation out of all proportion to the moderate cost of the materials which must be purchased to make the change.

Whenever you have to replace an old flush switch, either because it is shabby or has become defective, the necessary steps are as follows:

First, remove the cover from the old switch by taking out the two screws. Second, take out the screws with which the wires are connected to the switch and remove the switch fully from the outlet box. Third, remove the terminal screws from the new switch, slip them through the loops on the ends of the wires, and replace them in the switch. Fourth, put washers, which are furnished with the switch, on the screws, if necessary to bring the surface of the switch flush with the plaster, as shown in the upper illustration. Then fasten the switch in the box and adjust it to a vertical position. Fifth, attach the new cover plate.

Open the main house switch before doing any of this work.

WINS 1st PRIZE

Cost

\$4.98



MAYFLOWER

The Ship that brought the Pilgrims to America

Size: Height 25", Width 9", Length 27"



SANTA MARIA

The Flag Ship of Columbus in the Discovery of America in 1492

Size: Height 25", Width 11", Length 27"

THESE MODELS CAN BE ASSEMBLED IN A FEW HOURS

MRS. CLARRAH J. BIERBOWER of Philadelphia *wins first prize in Science and Invention Model Contest.* The parts for the ship model entered by Mrs. Bierbower are supplied by miniature ship models at a cost of \$4.98. The model entered was the same as the "Santa Maria" pictured above, no extra parts were added to those supplied by us.

This is the first time that the Grand Prize has ever been awarded to a woman. You can build a prize winner from parts supplied by miniature ship models.

We, the world's largest builders of ship models will help you build a prize winner by supplying all the parts cut to fit, and ready to assemble for either the "Santa Maria" or "Mayflower".

List of parts supplied for "Santa Maria": Space does not permit describing the parts for Mayflower but it is just as complete in every detail. Hull and keel, 3 pieces, rudder,

rudder support; 6 house pipe rings; 6 cannons, 6 port shutters; 11 shields, front and poop deck sides; railings; upper deck with decorated stern; colored picture for stern, rigging channels, anchor; lamp and bracket, crow's nest, how sprit and yard arm, 3 masts, fore, main and mizzen, spanker boom, jib yard arm, fore mast yard arm, main sail yard arm, top sail yard arm and lateen sail yard arm; wire for sails, brass name plate, rigging cord (light and heavy); brads, staples, glue, pulleys or blocks and falls, rear balcony, rear balcony railings, side balconies, side cabins, flags, ladders, 18 bumping strips, jib sail, fore sail, main sail; top sail and mizzen sail, stand, 3 pieces, over hull and parts are made of wood. This is not a cheap cardboard imitation. Shipping weight, 6 pounds. All Canadian and foreign orders must be accompanied by Money Order for \$4.98, plus a sufficient amount for Parcel Post charges.

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for Everyone**

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Please send me the completed parts, cut to fit, and ready to assemble for the Model.

I will pay Postman \$4.98, plus postage a few cents,

Please Print Name and Address Plainly to Avoid Delay

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CITY _____

STATE _____

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**"I
wouldn't
part
with
it"**



"That's how I feel 'bout the new Cheney Finishing Hammer. Haven't used it very long neither, but long enough to know it's a heck-ya fine hammer."

"Look at th' slender hickory handle on this Cheney. Just what I've always wanted for finishin' work. It's light and easy to grasp and has a spring in it that makes it rebound from the nail in great style. 'N this high crown on the business end of th' Cheney—why I never find any of th' usual hammer marks on my finishin' work."

"The Cheney's a great little Finishing Hammer, all right, 'n I wouldn't swap it for a dozen other hammers!"



A Strong Joint for Boxes

How to Lay Out and Make a Tongued Corner with Backsaw and Chisels

By EMANUEL E. ERICSON



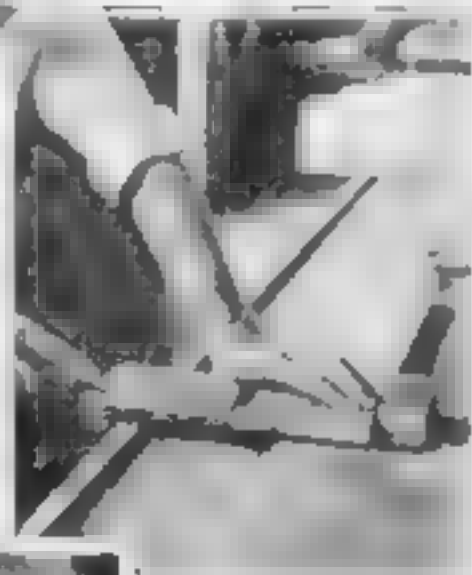
1 Square the board by sawing a groove in the side of the board. Run the gage up and down the edge. Next square a wide line on the outside of the board 3/4 in. from its end.



2 Gage the line for the groove on the board. Run the gage up and down the edge. Next square a wide line on the outside of the board 3/4 in. from its end.



3 Now mark for the groove on the board by passing the second piece against the knife line on the first board. Make a mark opposite the gage line. Here square a knife line across the first board.



4 Use a fine backsaw for the cross cuts on both boards. Hold the work firmly, as on a bench hook. Saw right to the middle of each knife line and on the proper side of it. Stop sawing when you reach the correct depth.



5 While some may prefer to finish the tongue or tenon with a rip saw, I find it easier to use a fairly wide chisel. For the corresponding groove on the other board, a narrow chisel must be used. Be careful not to mar the edges of groove.

6 The joint should go together with the pressure of the hands, if it is too tight, it is apt to burst. Glue the joint in any but rough work, and nail the parts together securely.

How to Thumb-Slot Your Phone Book

By ARMSTRONG PERRY

ONE of the annoying experiences in life is to try to find a name in a telephone directory, when time is money or when the loss of a minute may mean the loss of a train. A man in England is reported as making \$5,000 a year by

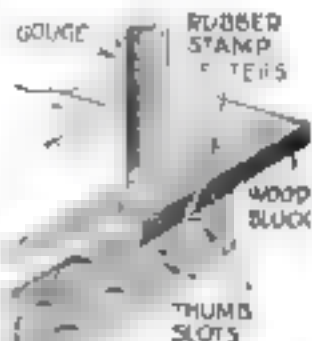
The first step in thumb-slotting a telephone directory is to cut the slots with a gouge.



going from office to office and house to house thumb-slotting telephone directories at two shillings each.

All the equipment needed to index your own telephone directory is a half-inch gouge (concave chisel), preferably with an inside bevel; a hammer or mallet, a rubber stamp alphabet with letters of a size to go within the semicircular slot made by the chisel, and a thin board.

The board is laid between the pages of the book where the A section ends and the B begins. The gouge is placed at the edge of the front cover near the top, and driven through the paper to the board. The board then is placed between the pages where the B's end and the C's begin. The gouge is placed below the first slot and a similar slot is cut. The process is repeated until the bottom of the book is reached.



The method of cutting and lettering the slots.

If the whole alphabet has not been covered, the slot for the next letter is cut at the top of the book, through just enough leaves to give room for the thumb. These second row of slots should be alternated with the first row. This should be planned carefully at the start.

In directories containing the lists for several towns, the slots may be arranged according to towns.

When the slots are all cut, the rubber stamp letters can be placed.

City directories, dictionaries and other reference books may be indexed in the same way.



Refinish It Yourself— with *Kyanize* Motor Car Enamel —the quick, easy, safe way

YES, sir, you *can* do it yourself! Any man, or woman for that matter, who can wield a brush can *make new* and *keep new* the finish of an old car. Kyanize Motor Car Enamel will do it. Mixed, ready for instant use, you flow it on with a good clean brush over the well-cleaned surface, give it a day to dry and proudly exhibit it as a *new* car.

Nothing to mix, nothing to add, levels itself and leaves no brush marks, ridges or laps. Dries hard in less than 24 hours. Wears and shines like polished metal. Water and weatherproof.

Use it anywhere about the home, too, on porch and garden furniture, toys, boats, canoes—and a hundred other places. For cushions, tops and upholstery use Kyanize Top and Seat Dressing—a worthy companion to Kyanize Motor Car Enamel.

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Send your name and address for FREE Book "How to Paint Your Automobile"



\$1. Trial Offer. If your dealer cannot supply you send us his name and **ONE DOLLAR** for a full pint can Kyanize Motor Car Enamel, state color desired in Leather Top and Seat Dressing state which, together with a good brush to apply. We'll also include a copy of our book, "How to Paint Your Automobile." Colors: Black, Red, Brewster Green, Taxi Yellow, Coach Blue, and other colors.

Simply brush it on!

Kyanize

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STAR HANDY GUIDE for HACK SAW USERS

★ HAND BLADES

Material to be cut	SPECIAL FLEXIBLE			FLEXIBLE BLADES			ALL HARD		
	Length	No. of Teeth	Order No.	Length	No. of Teeth	Order No.	Length	No. of Teeth	Order No.
Large Stock	6"	14	814SF	8"	14	814F	8"	14	814
	8"	14	914SF	9"	14	914F	9"	14	914
	10"	14	1014SF	10"	14	1014F	10"	14	1014
	12"	14	1214SF	12"	14	1214F	12"	14	1214
Ordinary Work or General Use	8"	18	818SF	8"	18	818F	8"	18	818
	9"	18	918SF	9"	18	918F	9"	18	918
	10"	18	1018SF	10"	18	1018F	10"	18	1018
	12"	18	1218SF	12"	18	1218F	12"	18	1218
Pipe, Drill, Plates, etc.	8"	24	824SF	8"	24	824F	8"	24	824
	9"	24	924SF	9"	24	924F	9"	24	924
	10"	24	1024SF	10"	24	1024F	10"	24	1024
	12"	24	1224SF	12"	24	1224F	12"	24	1224
Thin Pipe Light Sheets, etc.	8"	32	832SF	8"	32	832F	8"	32	832
	9"	32	932SF	9"	32	932F	9"	32	932
	10"	32	1032SF	10"	32	1032F	10"	32	1032
	12"	32	1232SF	12"	32	1232F	12"	32	1232

★ POWER BLADES

	HEAVY—ALL HARD				LIGHT—ALL HARD			
	Length	Gauge	No. of Teeth	Order No.	Length	Gauge	No. of Teeth	Order No.
Ordinary Work or General use	12"	18	30	1230	12"	21	14	1232
	12"	18	30	1218	12"	21	14	1242
	14"	18	30	1430	14"	21	14	1442
	14"	18	30	1418				
	16"	18	30	1618				
	16"	18	30	1610				
	17"	18	30	1710				
	18"	18	30	1810				
	21"	18	30	2110				
	24"	18	30	2410				
Light Structural Shapes, Pipe, etc.	12"	22	34	1234A	All Hand Blades are 22 gauge—except Special No. 1428 for Large Stock which is 22 gauge.			
	14"	22	34	1434A				
	14"	22	34	1418				
	16"	22	34	1618				
Heavy Structural Shapes and Sawing	17"	22	34	1718				
	18"	22	34	1818				
	21"	22	34	2118				
	24"	22	34	2418				
Large Solid Stock	14"	18	8	1418B				
	14"	18	8	1418B				

A Built-in Bookcase for Your Bedroom

By EDWIN M. LOVE

FAVORITE books that find their way into one's own room for the pleasant privacy of bedtime reading may be kept accessible yet neatly in order, by the use of the small built-in bookcase illustrated. The construction is very simple, and it can be installed merely by cutting out a rectangle of plaster between two studs (upset wooden wall supports). Thus no floor space is taken. The depth of 5½ in. affords enough room for the average novel or other relatively small book.

The materials needed are a board 1 by 6 in. by 8 ft. and another 1 by 8 in. by 8 ft., pine, surfaced four sides and sanded, 1 piece ½-in. quarter-round molding, 8 ft. long, and 4 pair of shelf hooks.

Smooth up and plane to a width of 5½ in. two pieces of the 1 by 6 in. pine, 8 ft. 8



Even in the smallest bedroom there is room for installing a neat little bookcase like this.

"For fast cutting I use Star Hack Saw Blades"

Says G. R. SALTER, Maplewood, N. J.

5 points of the Clemson Star

1. CLEMSON EXPERIENCE
125 years of the combined experience of the Clemson family.

2. CLEMSON STEEL
Specializing in the manufacture of correct manufacturing processes.

3. CLEMSON TEETH
The correct angle and rounded gullet of the teeth are the main factors in fast cutting, strength and endurance.

4. CLEMSON SET
The teeth are set in a manner to maintain the proper clearance to keep the cut free of chips.

5. CLEMSON TEMPER
The heat-treating methods used give the blades an extraordinary degree of strength, toughness and uniformity.

Every STAR Blade is branded with a STAR

"YOUR Star Hack Saw Blades are miles ahead of any blades I have ever used or seen and I surely do sound their praises at every opportunity. It is a treat to be able to saw a piece of conduit or cable without having a blade snap off. They clear the cutting channel and operate very smoothly—for fast cutting you can't beat Star Blades."

Different Blades are required for different types of machines. Be sure you are using the right type of blade for the work you are doing. Write Hack Saw Blade Headquarters for full information as to the blade you should use to get the greatest speed and efficiency in your production operations.

FREE.—Let us mail you our large hack saw chart to be placed on your wall for handy reference.

HEADQUARTERS for HACK SAW BLADES
Since 1883
CLEMSON BROTHERS, INC.
MIDDLETOWN, NEW YORK

STAR HACK SAW BLADES



in. long. Square a line across 1 in. from both ends of one piece, giving an exact distance apart of 2 ft. 6 in. Gauge a line around the ends ½ in. from the face and saw out the rabbets for the upper and lower jambs (see the illustration on the following page). Use this piece as a pattern for the other side.

Gauge light pencil lines 1 in. from each edge, and, centering on these, bore ¼-in. holes ½ in. deep every 2 in. along the length. These are for shelf hooks.

Make an upper and a lower jamb of 1 by 6 in. stock, planed and cut to 5½ by 12½ in. The two halves are like them, but 12 instead of 12½ in. long.

For a back, cut a rectangle of ¾-in. 3-ply panel veneer 13½ in. by 2 ft. 7½ in. A sheet of heavy fiber wallboard may be used instead of the plywood and, of course, will cost less.

Assemble the sides and the end jambs by nailing through top and bottom jambs into the sides with sixpenny finishing nails. First clamp the sides against the ends of the top and bottom jambs to insure snug joints. (Continued on page 64)

GOODELL - PRATT

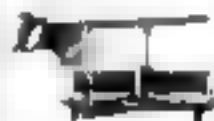


**High-speed, High-power Bench Grinder—463, Heavy Die
Bench and Armature for High Abrasive Wheel, 3 x 1". Ad-
justable Work Rest. Finishes 1/2 and 3/4 hp. motor. A
high speed bench. \$16 ea.**

Quadrant-Fram Electric Drill, Suction
w/ Lights an. Heavy Duty an.
A D and 320 A C & D C Solidly
drilling down to carbide base Drills.
Vital parts really accurate. These
drills start from \$16-159

[illegible]

All-around Spring Box 289. Compact bend
to allow the wire and coil to adjust
to either hand and are secured by side
adjustment levers and are regulated
to any desired depth. Exported with
the **all-around Spring Box** 289.

[illegible]

GOODELL - PRATT



Marshall Bar Plaque—T&D. 16" except "Bar" had head on entire headlight. C. 114 248 2 1/2 in. similar to available ones. Fitted metal cover. Square above lens. Finished on outside. 10 1/2"

[illegible]

Room 1100-745 Just today for these
enjoy being in ID we will aligning and
can be taken out by setting single
pave Ball and wheel a very thick
on side of road in (100 ft) away from
+ 100 back to 100 ft 100 ft
back to 100 ft 100 ft

Tech Speed Hand Drill- \$1 Mark
get it and have it up there as a
\$100. It's a good one. Mark drill B
\$100. Get it from the \$100. Get it.

[illegible]

GOLF is an extremely competitive sport, and the players pictured here are single examples of the skills in which each is made. The catalog also features all kinds of tools for machinists, and professionals and amateur mechanics.

400 pages of fine tools *FREE*

Select your tools from this catalog—then buy

them from your hardware dealer, mill supply or automotive supply dealer

THIS 400-page catalog is used by carpenters, mechanics, and machinists—who select from its pages the tools they need—and buy them through their local hardware or mill supply man.

You, too, will find this a pleasant and easy way to buy tools. A three-page index helps you find what you want—at once. Clear, easily understood descriptions and good pictures leave nothing for you to guess at.

Whether you make your living with tools or

use them to follow a hobby, you need this booklet, with its 400 pages of pictures and information.

Goodell-Pratt Tools will serve you well for years. No finer tools are made than those that bear the name of Goodell-Pratt.

Select your needs from this catalog; then buy them from your nearest dealer. If he doesn't carry the Goodell-Pratt line, write us for the name of a dealer who can supply you.

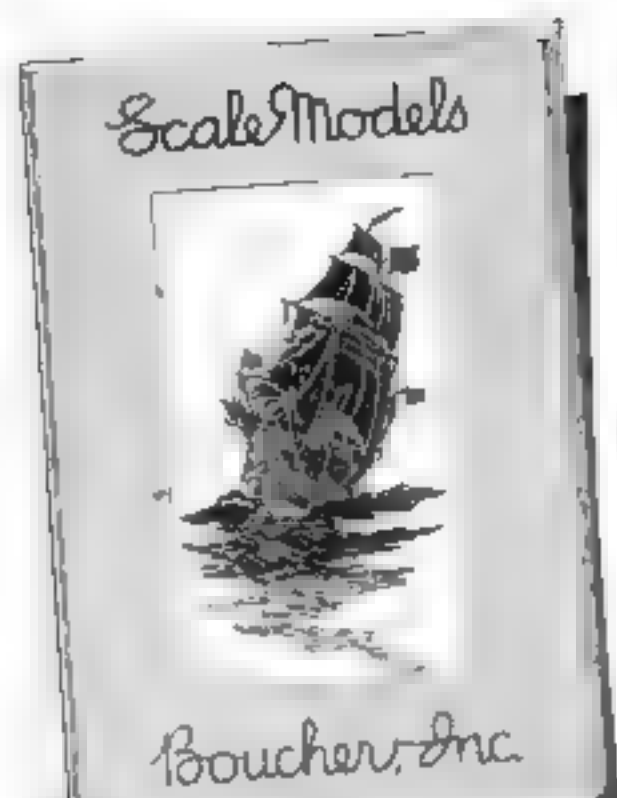
For the catalog, address

GOODELL-PRATT COMPANY, GREENFIELD, MASS. U. S. A.

MAKERS OF *Footsmiths*, MR. PUNCH

GOODELL-PRATT

1500 GOOD TOOLS



First Aid for Builders of Ship Models Ancient and Modern

Plans—Scale Blueprints of historic and modern vessels, racing sail yachts and power boats.

Lumber—Selected white pine for hulls, straight grained spruce for spars, three ply veneers for decks, mahogany, etc.

Tools—Specially designed—Chisel—Gauges and Planes to fit exactly modelmakers' needs.

Hulls—Made to Scale of selected white pine in the rough partly finished or completely finished.

Boat Fittings—Blocks, Dead Eyes, Turnbuckles, Cleats, Chocks, Davits, Airports, Capstans, Binnacle, Rigging Line, Sail Latch, etc.

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Marine Engines—Complete Steam Engines, Construction Sets in different stages of completion, spring motors.

Steam Boilers—Made of seamless tubing, boiler fittings, blow torches.

This booklet has many pages of information useful to modelmakers, model yachtsmen and others on sailing Model Yachts.

Brief history of Steam Engines.

Illustration of famous models made by the House of BOUCHER.

Nautical terms in common use.

Parts of a sailing vessel—spars, rigging, knots, hitches and splices commonly used on boats.

Hints for painting and finishing Model Boats. Whatever type of ship—sail or steam—ancient or modern—you are building or planning to build, you will find the booklet "Scale Models" of tremendous help to you. Send 25c today for your copy. It will be sent to you by return mail.

Headquarters for Model Makers for 22 Years

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415 Madison Ave., New York

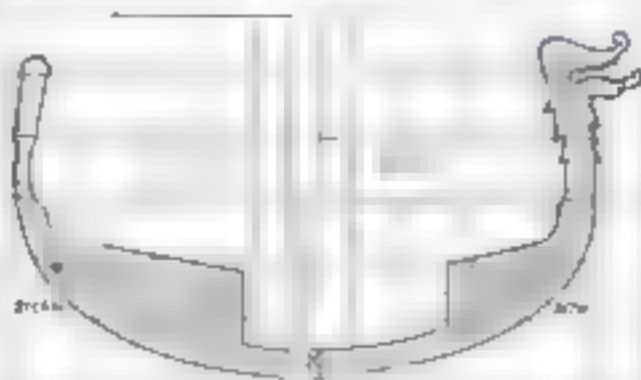
Gentlemen:
Enclosed is 25c. for which please send me your booklet "Scale Models."

Name _____

Address _____

A Ship Model All Can Build

(Continued from page 71)



To simplify the construction, the keel, stem and sternpost are in one piece of $\frac{1}{2}$ in. thick plywood.

through the corner to these lines at several places. With a chisel chip out the waste wood to these saw cuts; then with a gouge or chisel cut away the rest until the blocks are about $\frac{1}{2}$ in. thick, with square ends, as shown. If the bow and stern decks are to be built up, these square ends also will be cut away, as mentioned before, and the whole of the hull pieces will be of the one thickness.

These two pieces now should be glued on to the centerpiece, being careful that they are evenly placed and that the bow end of them is toward the bow end of the centerpiece. Leave these three pieces clamped or wedged together for twenty-four hours to allow the glue to set thoroughly.

Hold the model up directly in line with the center of your light and see if you can detect any inequalities between one side and the other, or bumps or hollows. There should not be any but if there are, smooth them out, because a symmetrical

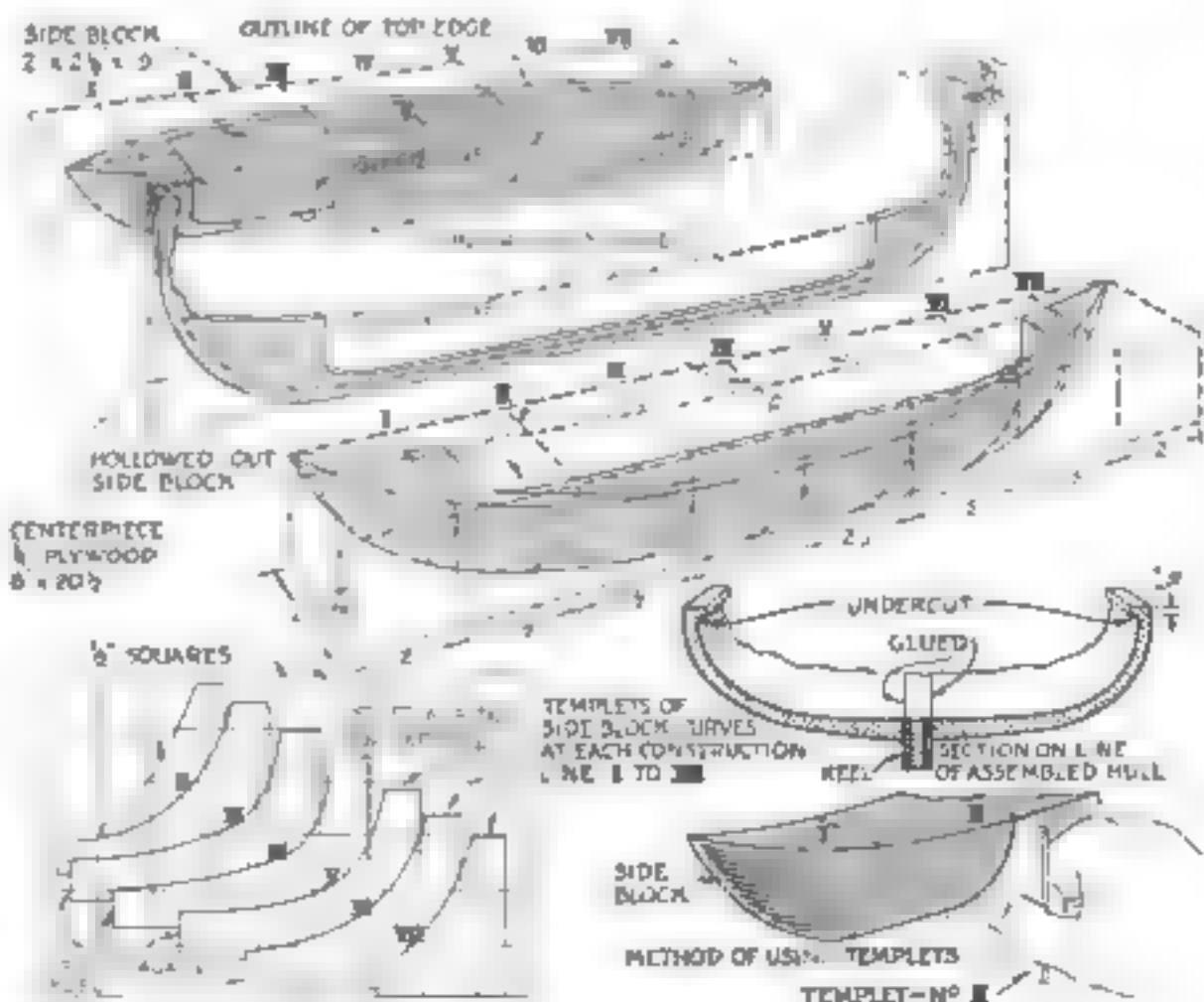
whole is more important than exact adherence to the lines given.

If you are able to make a neat job of it, the edges of the planks should be shown on the outside. The Gokstad ship had about thirteen planks to a side, but the Oseberg had only nine, and that will be as many as will look well on our model. Therefore, divide the side of the hull and ships into nine even squares. Draw lines with a soft pencil along the hull so that the lines gradually draw together and curl up a bit to the ends, hold the model up to the light and look

along the lines to see that they flow evenly. With a sharp knife cut into the hull at these lines about $\frac{1}{16}$ in. deep. Then, with a small chisel held almost flat on the hull, cut up to these lines, thus forming right-angled grooves with their edges down, giving the appearance of planks, as with an ordinary clinker-built row boat. How to do this is illustrated on page 71. This is not so difficult, but if you cannot do it neatly it is better not to do it at all.

Now proceed to gouge out the hull considerably thinner. Run another pencil line round the top edge a full $\frac{1}{2}$ in. from the edge and work gradually down from this to the bottom, where the inside of the hull should be level with the top of the centerpiece, here more properly called the keelson. Shave as thin as you safely can, but be very careful not to cut through. Holding the hull up to a bright light and watching for any transparency will give you

(Continued on page 80)



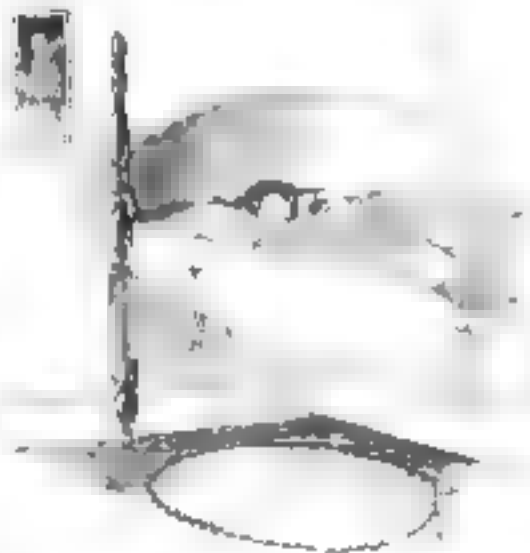
Centerpiece, side blocks and templates for shaping the hull. These and all other details are given full size in Popular Science Monthly Blueprints Nos. 61 and 62, which are listed on page 92.

Making a Big Bed Safe for Children's Use

By FRANK I. SOLAR

YOU may never have heard of a bed rail "saddle," but you have heard of the little folks falling out of bed. And bed rail saddles are intended to prevent just that. They are added to a big bed whenever it is to be used by small children and are stored away when not in use.

Any wood you have at hand will serve for the saddles as they are to be painted some bright color. Plane the surfaces, cut the ends square and hold the piece along side the bed rail, if it is not perfectly



One or two bed rail "saddles" are added when children are to sleep in a large bed.

straight, so that you can trace the pattern to be cut on the bottom edge. Also lay out the curves on upper edge and one end.

With a turning or coping saw cut carefully to the lines. Smooth the edges with a wood rasp or coarse sandpaper and finish with fine sandpaper. The paper should be wrapped over a round or oval stick, so it will fit the irregular curves.

The cleats are fastened with screws or stove bolts. If the latter are used, file the ends so the bed clothing will not catch on them. If your saddle is not as thick as the bed rail, fill out between the cleat and saddle with cardboard.

A Ship Model All Can Build

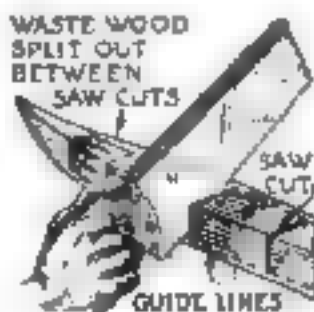
(Continued from page 88)

sufficient warning of dangerous thinness.

At about $\frac{1}{4}$ in. from the top edge there should be a sharp cut-under of about equal depth, and from there an even curve to the keelson. Sandpaper the top reasonably smooth inside.

That completes the main part of the hull of our leaf-shaped serpent. It is, in fact, very similar to the ship in which another leaf, the son of Eric the Red discovered America.

Next month we shall put on the gunwales and interior fittings. Already, however, our model is interesting and good to look at.



A few saw cuts make it easy to hollow out the two side blocks.

How Thick Is A Page Of POPULAR SCIENCE MONTHLY?



The thickness of a page of this magazine—.0027 of an inch—is several times as great as the variation frequently allowed in machine tool work.

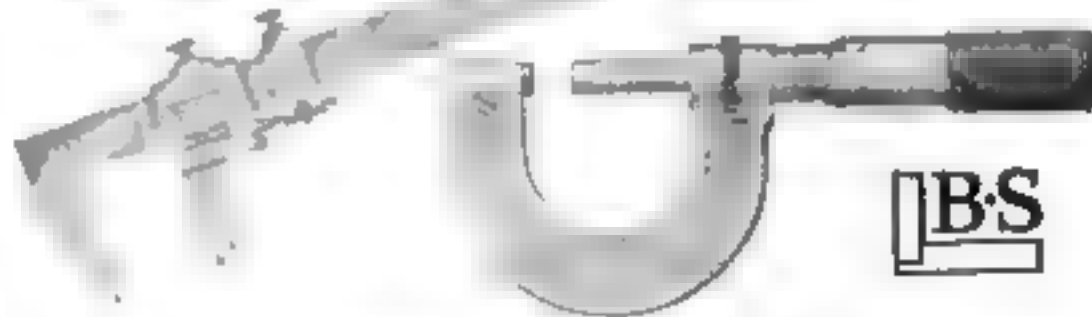
For making measurements twice, four and frequently ten times as fine as this, mechanics the world over rely on Brown & Sharpe precision tools.

These tools are used in both commercial manufacturing and the finest of tool work. They are used every day in making fine measurements in mechanical industries where accuracy is a paramount point.

It pays to look for the Brown & Sharpe trade mark when selecting precision tools. For it represents performance recognized everywhere as the world's standard of accuracy.

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PEXTO Tools
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especially designed to
do properly the work for
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The Pexto line consists
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Drivers, Snips, Squares,
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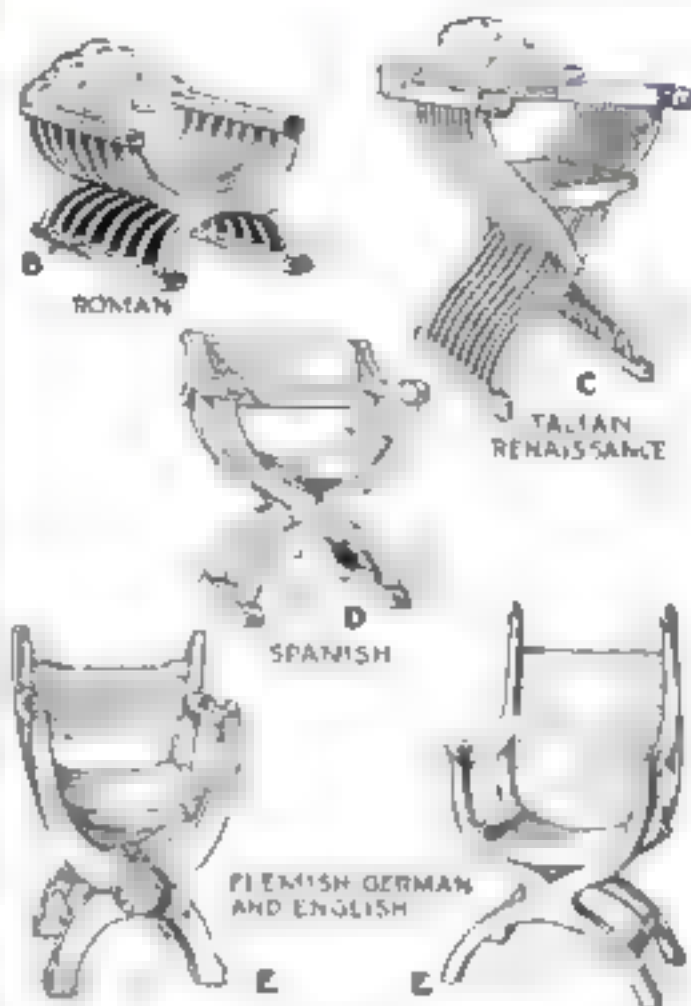
No. 45
Adjustable
Angle
Wrench

Sizes
4" to 18"
Forged
Steel

PEXTO

You Can Build This Armchair

(Continued from page 22)



Five typical designs for cross-legged armchairs. The Spanish type (D) is especially popular at the present time. The carving often is most elaborate.

permits a degree of flexibility. The broad leather seat and rather high back of leather adapt themselves to body pressure, so we have a very comfortable chair.

In this sketch (G, page 31) we have a semifolding chair; it has a sort of rule joint for the center which permits the arms to be brought together and the chair to be folded so it may occupy a smaller space. The seat is of heavy leather, while the back is made from a piece of cotton belting or webbing covered with leather. The flexibility thus gained permits greater adaptation to the position of the body and as it has a wider seat and back than the others, it is a wonderfully comfortable chair.

"Why don't we see more of
of these chairs?" asked Val.

WELL, there are various reasons. The very fact that they are not being purchased by the rank and file of furniture buyers means that few are manufactured, hence methods of mass production cannot be economically applied. Of course, that makes the price higher than for other chairs of more usual forms. The more elaborate and heavier chairs (C, D and E) are suitable for club and lodge rooms, anterooms and libraries, rather than for homes, where they seldom have the setting or vista to do them justice. Besides this, the legs must be sawed from a plank so the grain will give the greatest strength possible to each leg. This causes such

a waste of high grade lumber that the chair is not favored by designers and manufacturers of commercial furniture. Such a chair is a luxury unless, of course, you make one yourself, and get a seventy-five dollar chair for perhaps fifteen dollars or less in materials."

VAL had been examining carefully one of the dimensioned drawings (G) in the sketchbook. Now he said enthusiastically:

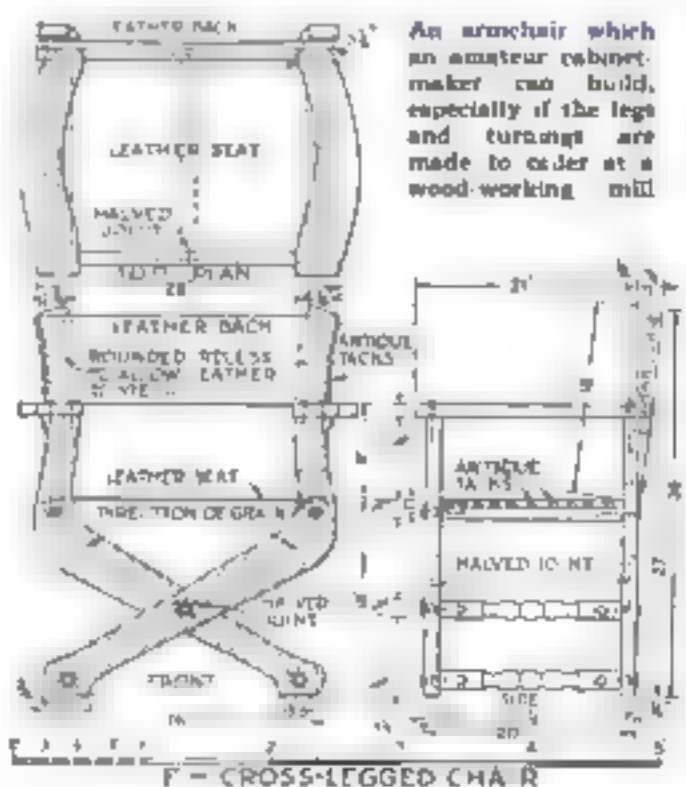
"I believe I will make one of these chairs this winter for my 'evening-at-home' job. It will be fine in the hall beside the fireplace if finished in dark oak and upholstered with Spanish leather. How can I get just the right curve to the arms and legs from this sketch? I think I shall have them sawed at the mill, for I would find more hard work than pleasure if I tried to saw them from oak plank with a handsaw."

"You are right there," answered Jimmie, "and it is a simple matter to transfer and enlarge the curves. Make a sketch to a scale of say, one and one-half inches equals twelve inches and lay out squares like these—"

Jimmie took a pencil from his pocket and sketched rapidly, while Val watched him.

"These legs," explained Jimmie, "then may be enlarged to any size, and the curves accurately reproduced by drawing larger squares upon stiff cardboard. In this case they would be two and one-half by two and one-half inches. Draw the curves through them in the same relation as in the small sketch. Then cut the pasteboard to the lines and you have a pattern that may be used in marking the legs upon the plank preparatory to hand sawing. The arm, and in fact any curved line may be—"

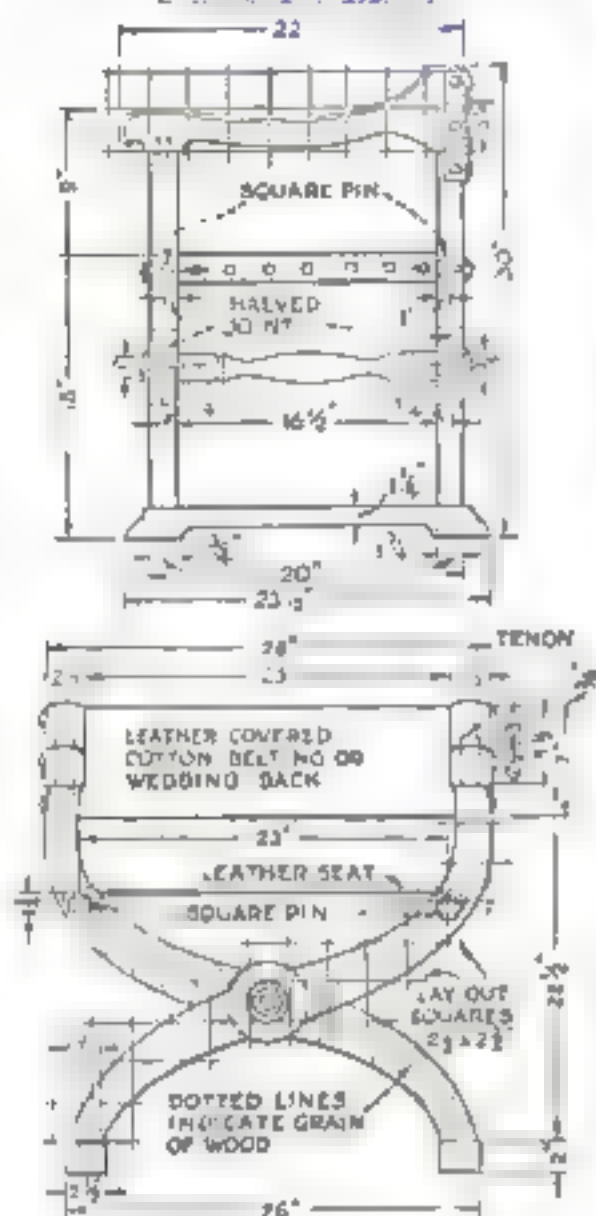
(Continued on page 31)



An armchair which an amateur cabinet-maker can build, especially if the legs and turnings are made to order at a wood-working mill.

You Can Build This Chair

(Continued from page 80)



G - SEMI-FOLDING CHAIR

Working drawings of a fine type of cross-legged chair. Compare with D, page 90

enlarged in exactly the same manner."

"I understand perfectly," said Val. "I will work this out with a great deal of care and will have a lot of fun making the chair this winter. I think nothing else in the construction will give me much trouble. Anyway, I shall see you frequently and if I get in a tight place perhaps you will help me out."

"Gladly," promised Jimmie.

Straightening a Saw



By the skilful use of nail set and hammer it is often possible to remove saw kinks

A FRIENDLY carpenter recently showed me how he removes a "kink" in a hand-saw blade. He laid the blade flat on a hardwood block with the bulge of the kink upward. Then, with a nail set or drift and a hammer, he worked along the blade, as indicated by the dotted line, and hammered it flat. The weight of the blows was heaviest where the bend was highest. F. H. T.

Where A Forced Landing Meant Death!



When Lieutenant Walter Hinton made his flight up the valley of the Amazon seeking the source of the Parima Watershed, he had to stay in the air. For below stretched an impenetrable forest where a landing meant certain death.

All tools but one had been stripped from the plane in order to save gasoline. That one was a NICHOLSON File. Lieutenant Hinton says:

"We cut our NICHOLSON File in half for the weight saved represented a pint of gasoline. But half a NICHOLSON File was far more useful to us than any other tool would have been. It could do a score of repair jobs in the air."

This striking proof of the usefulness of NICHOLSON Files is equalled only by their convincing record doing everyday jobs in industry and the home.

Lieutenant Hinton carried a 6" Flat Bastard File. Your hardware dealer can show you a duplicate — also the rest of the NICHOLSON line.

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There's no Hammer like a Maydole

The experienced carpenter or mechanic will tell you that the Maydole is the finest that human skill, press-forged tool steel and clear, second-growth, air-dried hickory can produce. The Maydole Hammer has been the choice of the craftsman since 1843.

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**Maydole
Hammers**

The David Maydole Hammer Co., Norwich, N.Y.

What My Shop Taught Me

(Continued from page 7.)

power, and this does away with the other grinder, as I can use the wheel attached to the lathe with much better results.

Perhaps the old grindstone, with its trough of water, as used by our forefathers, was the better way of grinding tools. But it is too slow for this swift-age and modern emery and carborundum wheels make a faster job of it. But we must look out lest we spoil the tools by pressing them too hard and long against the wheel and overheating them.

A few of the things I have made are illustrated. The cedar chest was built entirely by hand from rough cedar purchased in the form of 1-in. planks.

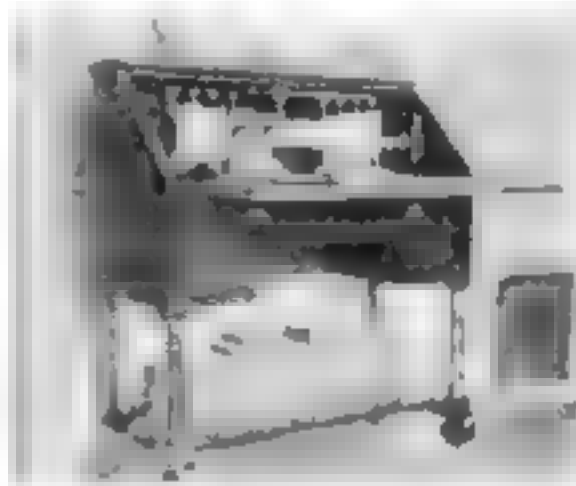
Of the other things I have made—and enjoyed the making—may be mentioned three winter tops for three different cars, a Colonial mahogany desk, a Martha Washington sewing cabinet, a piano lamp, a radio set and cabinet, a corner

cabinet for the breakfast room, an umbrella stand, medicine chest, all our kitchen furniture, including a porcelain top table, and one commercial job—a dental cabinet. This last piece was constructed of solid mahogany, white enameled inside with porcelain shelves, glass doors and a long bench, horror running the full length. To make so elaborate a piece was no easy task.

I am looking forward eagerly to the time my little daughter is six years old, for then I plan to make a complete bedroom set for her with a bureau, bed,

chest of drawers, chairs, and a desk, all in miniature size, painted French gray and decorated in blue. I shall also see that she gets a doll's house.

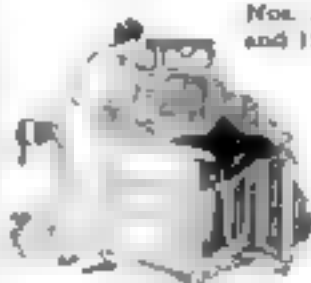
So, in summing up, I may say that my little workshop means everything to me. It gives me just what I need—a rest in change—when I get home after a hard day's work.



A desk of Mr. Strand's own design, which he constructed of mahogany throughout.

Complete List of Home Workshop Blueprints

ANYONE of the blueprints listed below can be obtained for 25 cents. The blueprints are complete in themselves, but if you wish the corresponding back issue of the magazine, in which the project was described in detail, it can be had for 25 cents additional so long as copies are available. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.



Nos. 2 and 13

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

GENTLEMEN

Send me the blueprint, or blueprints, I have underlined below, for which I enclose _____ cents.

No.	Title	Issue and Date of Issue	Price
1	Sewing Table	Feb., '22	25c
2	Smoking Cabinet	Mar., '22	25c
3	End Table	Apr., '22	25c
4	Kitchen Cabinet	May, '22	25c
5	Shaving Cabinet	June, '22	25c
6	Arbor Gate and Seats	July, '22	25c
7	Porch Swing	Aug., '22	25c
8	Bench and Tilt Table	Sept., '22	25c
9	Electric Washer	Oct., '22	25c
10	Tea Wagon	Nov., '22	25c
11	Clothesline Toys	Dec., '22	25c
12	Workshop Bench	Jan., '23	25c
13	Sound Radio Cabinet	Feb., '23	25c
14	Cedar Chest	Mar., '23	25c
15	Phone Table and Stool	Apr., '23	25c
16	Grandfather Clock	May, '23	25c
17	Flat Top Desk	June, '23	25c

No.	Title	Issue and Date of Issue	Price
18	Colonial Desk	Apr., '23	25c
19	Cabinet and Desk	Apr., '23	25c
20	Pergola Garage	May, '23	25c
21	Gateleg Table	June, '23	25c
22	Camp Bedding Outfit	July, '23	25c
23	Baby's Crib and Pen	Sept., '23	25c
24	Kitchen Cabinet Table	Oct., '23	25c
25	Pullman Play Table	Nov., '23	25c
26	Toy Tea Cart, etc.	Dec., '23	25c
27	Tool Cabinet, etc.	Jan., '24	25c
28	Sewing Cabinet	Feb., '24	25c
29	Chinese Game Table	Mar., '24	25c
30	Dining Alcove	Apr., '24	25c
31	Garden Trellises	May, '24	25c
32	Simple Radio Cabinet	June, '24	25c
33	Rush Bottom Chair	Nov., '24	25c
34	Wooden Bench	Dec., '24	25c
35	Sheraton Table	Jan., '25	25c
36	Salem Chest	Feb., '25	25c
37	Desk in Sheraton Style	Mar., '25	25c
38	Gas Tube Radio Set	May, '25	25c
39	Three-Stage Amplifier	June, '25	25c
40	First Tube Receiver	July, '25	25c
41	Pirate Ship Model—Hull	Feb., '26	25c
42	Pirate Ship—Details	Mar., '26	25c
43	Galleon Model—Hull	May, '26	25c
44	Galleon Model—Details	June, '26	25c
45	Sailing Yacht Model	July, '26	25c
46	Broom Cabinet	Aug., '26	25c
47	Airplane Model (Flying)	Sept., '26	25c
48	Clipper Ship Model—Hull	Oct., '26	25c
49	Clipper Model—Details	Nov., '26	25c
50	Clipper Model—Rigging	Dec., '26	25c
51	Five Tube Radio Set	Jan., '27	25c
52	Five Tube Set—Details	Feb., '27	25c
53	Bird and Animal Toys	Mar., '27	25c
54	Constitution Model—Hull	Apr., '27	25c
55	Constitution—Rigging	May, '27	25c
56	Constitution—Rigging	June, '27	25c
57	Welsh Dresser	July, '27	25c
58	Viking Ship Model—Hull	Aug., '27	25c
59	Viking Ship—Details	Sept., '27	25c

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Bird House Is Small Copy of Its Owner's Home

IF YOU enjoy model making, why not build a bird house that is a miniature of your own home? That is what we did. Our bird house, as the illustration shows,

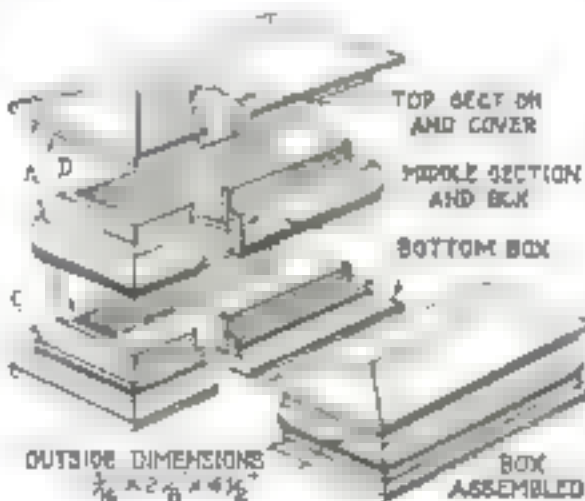


is an exact model of our own house. It has a door set in and carved exactly as in the big house and, of course, it is painted the same color. The miniature window boxes serve as perches. —GORDON H. SEARS.

Mystifying Stamp Box Has Secret Compartment

USUALLY one not in the secret will pick up the top of this box and find merely an assortment of pins, paper clips, rubber bands and pen points. The knowing one, however, will grasp the middle section and lift both it and the top, thus revealing the secret stamp compartment in the bottom box.

In making the box, cut out the top $\frac{1}{2}$ by $2\frac{1}{4}$ by $4\frac{1}{2}$ in. and shape it as shown, and make the bottom, which is only $\frac{1}{4}$ in.



How the box is constructed. The bottom compartment is the one used for concealing stamps.

thick. Then inter and glue together the $\frac{1}{4}$ by $\frac{1}{2}$ in. strips which form the pin tray or middle section—it is $1\frac{1}{2}$ by $3\frac{1}{2}$ in. inside measurement—and glue the $\frac{1}{4}$ in. thick bottom in place. Around the outside of this tray glue the strip A, which is $\frac{1}{8}$ by $\frac{3}{4}$ in. Then glue strip B, $\frac{1}{4}$ by $\frac{1}{2}$ in., and strip C, $\frac{1}{4}$ by $\frac{3}{4}$ in., to the bottom. Glue strip D, which is similar to C, to the top. If cutting and assembling are done accurately, the box will close tightly, yet open easily.—C. A. K.



For that clean-cut look of success

try this invigorating massage after shaving

SUCCESSFUL men look the part. They are clean shaven, clean cut, and well groomed. They have that glowing look of health and vitality.

A muddy, half clean, blackhead-dotted skin can never be a partner of the successful man. Yet you can have the clean look of success. It takes no extra time. It can be acquired easily and pleasantly in your own home.

After you shave, use Pompeian Massage Cream. You usually use something after shaving—hot towel, lotion or cream—to remove the

dirt and clinging soap particles that become imbedded in the skin. Water, lotions, soaps—all reach the surface only. They do not remove imbedded dirt and secretions. Pompeian Massage Cream does.

Use this pleasant, gentle cream after shaving. See how your skin takes on the glow of life and action. See how imbedded dirt, even blackheads, rolls out under the mild but efficient urge of this quickly applied massage. You will like its restful, zestful "feel." Above all, you will like it for the feeling it gives you that—by gosh! you really are clean.

Make this convincing hand test free. Wash your hands thoroughly. Rub a little Pompeian Massage Cream into the back of your hand until the cream first disappears, then comes out again. Notice that the cream goes to push and compress black. The black



is dirt that you could not remove by washing. You can make this simple but convincing test costly. Get a jar of Pompeian Massage Cream in any drug store for sixty cents. If you prefer to make the test before you buy, merely mail the coupon below.

POMPEIAN MASSAGE CREAM

Increases Your Face Value

FREE - TO MEN ONLY

The Pompeian Company, Dept. 34, Cleveland, Ohio. Please send me free, the sample tube of Pompeian Massage Cream with enough cream to make the hand test and to give me several mailings.

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ATKINS SILVER STEEL SAWS

YOUR hardware dealer will show you a new Atkins Silver Steel Saw ready for a lifetime of better service in your home. It not only cuts easier and faster, but outwears many "cheap" saws. Look for the ATKINS name on the blade—save time, money and labor.

No matter how hard you work, your saw will hold its edge longer than any other. Atkins Silver Steel Saws are made in the U.S.A. by the best workmen in the world.

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A Built-in Bookcase



For a bookcase, use a piece of wood at least 1/2 inch thick and 1/2 inch wide. Use a hammer to drive the nails in.

Then nail on the bookcase slats. Use a hammer to drive the nails in. Saw off the projecting ends of the slats.

The case is now ready to use. Choose the best of all for the work by using the piece of wood which is the best of all. If you find it is well to have the piece of wood which is the best of all.

Use a hammer to drive the nails in. Use a hammer to drive the nails in. Use a hammer to drive the nails in. Use a hammer to drive the nails in.

PLUMB accurately, welding the steel with sharp ends on over the steel and the steel ends on the steel.

Cover the rough edges of the plaster with a piece of 1/2 inch plaster and plaster the box. Round off the outer edges to a fitting. Sand a 1/2 inch corner round is applied after the plaster is set. The plaster is set between the plaster and the box which holds the plaster. The plaster is set between the plaster and the box which holds the plaster.

Start a nail in the corner of the box. The nail is set in the corner of the box. The nail is set in the corner of the box.

Now, a block of wood is set in the corner of the box. The block of wood is set in the corner of the box. The block of wood is set in the corner of the box.

TRIMO

For Every Tool Chest or Bench



TRIMO Pipe Wrench

Distinguished in its leadership by special features that appeal to every man who appreciates good tools.

INSERT JAW: Replaceable when worn with hard service at a fraction of the cost of a new wrench.

NUT GUARDS: Keeps the TRIMO adjusted perfectly in close quarters or when laid down.

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PRESSED STEEL FRAME: Will not break, therefore, TRIMO is stronger and safer than most wrenches.

Right Steel Handle: sizes 4 to 48" Four Wood Handle sizes 4, 8, 10 and 14"

TRIMO Monkey Wrench

Is made mechanically correct. The leverage increased in proportion to the increased size of the nut or object to which it is applied. The drop forged movable jaw, lead outward instead of towards the handle to adjust.

Seven standard sizes—4 to 24 inches, inclusive.

**TRIMONT
MANUFACTURING CO.**
Roxbury Boston Mass.

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A Quick and Simple Way to Construct Window Screens

By A. J. PHELPS

WHEN making window screens, I follow a method that is the height of simplicity. It allows no chance for errors in measurement and, therefore, the screens are bound to go in place without any fitting and planing.

The two side pieces or stiles, which are $2\frac{1}{4}$ by $1\frac{1}{2}$ in. stock, are cut to suit the window frame, and the bottom rails are beveled to fit the slant of the sill. Then these parts are laid flat on the sill, and the center and top rails are marked for length, that is, the distance across the window less the combined width of the side pieces. The bottom rail is the same length, but is $2\frac{1}{2}$ in. wide. It also is beveled along one edge to suit the sill.

The shoes then are marked for the center fold at the height of the cheek



The strip of wood lying on the sill is a cross rail which is being marked for length.

meeting) rails of the window and the parts are nailed together.

When selecting is obtained of a width to lap over the frame $2\frac{1}{2}$ in. on each side for tack (Fig. 4). Piece 1 in. longer than the opening is cut off. The way I do this is to slit about 2 in. of one edge, grasp the slit with one hand and then draw a knife between the weave.

In tacking the wire, I first fasten one side and end. A piece of $\frac{3}{4}$ in. thick wood is then placed $\frac{1}{2}$ in. away from the remaining stile on the under side of the screen. The fingers are placed on the screen over this strip and the thumb is pressed on the edge of the stile. This gives all the tension needed while tacking the remaining side and end of the wire.

A 2-in. screen head is cut into pieces $1\frac{1}{2}$ in. longer and wider than the opening and nailed on, except toward the corners, which are left loose. A miter is sawed at each corner through both pieces of the head, and the nailing is completed. A head is bradded to the center rail and the net screen is ready for hardware.

This makes a light screen, but my experience has been that it is strong enough.

8 POWERFUL MOTOR-DRIVEN TOOLS

Think of it! The Super-SpeedWay Shop shown above gives you a complete wood-turning lathe, bench saw, a scroll or jig saw. All the necessary accessories for both portable and stationary power drilling, buffing, grinding, and cleaning.

The Super-Speed Way 56 sp. attached to any light motor car will carry it out as fast as a complete road and much more cheaply, right to your home.

**EASY TO MAKE THINGS AT HOME
WITH THE SPEEDWAY SHOP**

We are very glad that Miss Margaret Stewart, my niece and I will soon be leaving for a short time to visit my mother-in-law. I am a very busy person and I am not at home as often as I would like to be. We will be in the city for the first time in many years and we are looking forward to it. We will have a very good time and we will be very happy to see you. We will be in the city for the first time in many years and we are looking forward to it. We will have a very good time and we will be very happy to see you. We will be in the city for the first time in many years and we are looking forward to it. We will have a very good time and we will be very happy to see you.

Can Make Money with Speedway Shops

You can make almost anything attractive piece of furniture, too by the way, and get the most out of it. And, even better, the whole thing can be done in a short time if you use the right materials and tools. All you need is the right materials and tools. And, even better, the whole thing can be done in a short time if you use the right materials and tools. And, even better, the whole thing can be done in a short time if you use the right materials and tools.

\$19.95 DOWN—Balance Easy Payments

We make it easy for you to own one of these simple & popular Speed Way electrically operated Shop Vac. It is a true "go to it" unit as we say. It is guaranteed to give you a lifetime of good service and we will refund you the price of the Shop Vac minus the cost of the motor if the motor is found to be defective within one year of purchase. It is really easy to install and operate and it gives you the most easy monthly payments which you'll never have!

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DON'T PASS THIS UP!

We want you to know more about this exciting Ship Livery and it is highly profitable for you to have a hand in the work. A money-maker in the small-job area. A great idea for you to get the job done. Get the full particulars. Send in the coupon today!

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That's why we say "don't delay." For a limited time only we are making this special offer on the Speed King Sheep and tools. If you want to be in on it, fill out this coupon and send it to us now.

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1234 E. 43rd Ave. Cicero, Illinois.**

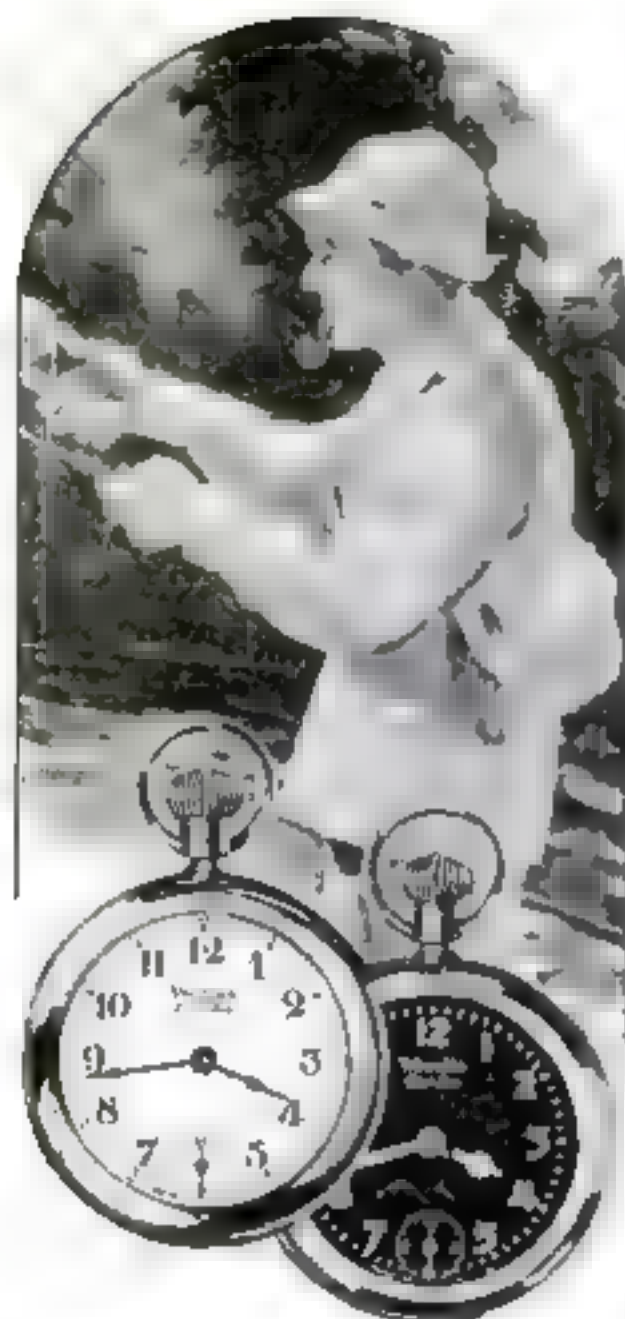
Dear Sirs: solicited in the **Power-Fire-Wall**
Company and will please send me full particulars
about the job and the price, free literature and
also pictures page on the **Speedway** Photographs.

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Address _____

I enclose _____

Phone _____



Outdoor men like *Pocket Ben*

HERE'S a steady, faithful, out-of-doors companion—a friendly little pal to take along when you're roughing it.

You can rely on Pocket Ben to measure the hours and minutes faithfully. He knows when it's starting time, meal-time, bed-time—no guess-work about it.

Pocket Ben is Big Ben's brother. The family name "Westclox" on his dial is your assurance of everything true and faithful in a time-keeper.

Sold everywhere—\$1.50.
With luminous night-dial
\$2.25.

WESTERN CLOCK
COMPANY
La Salle, Illinois

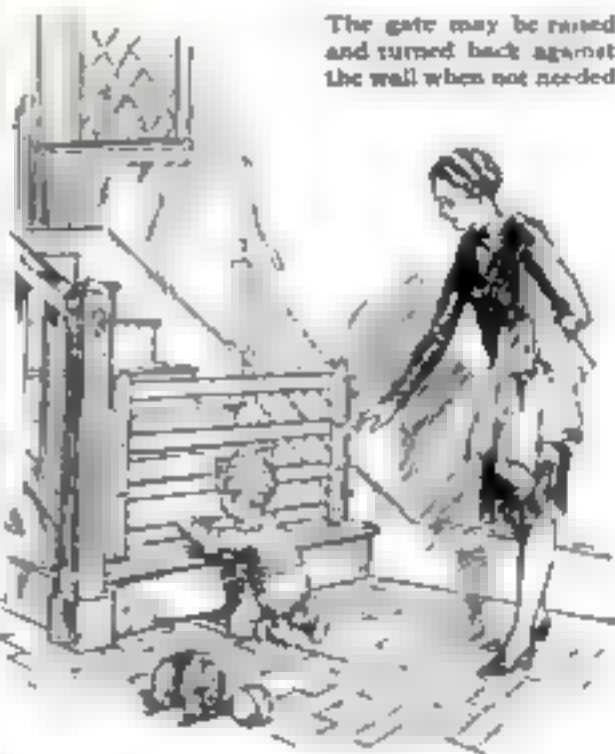
The SHIPSHAPE HOME

Gate for Stairway

To KEEP the baby from climbing up the stairs, I made a wooden gate that could be adjusted to the rise or angle of the stairway and swung back against the wall entirely out of the way.

The crosspieces of $\frac{3}{4}$ by $1\frac{1}{4}$ -in. strips were placed between two $\frac{1}{4}$ -in. thick up-

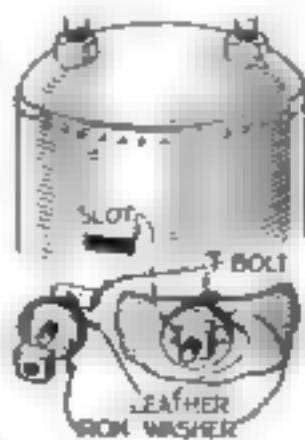
The gate may be raised and turned back against the wall when not needed.



rights at either end and fastened with a 1-in. screw in the center of each post. Four small screw eyes with a cord run through them were arranged to serve as a hinge. The other side of the gate is lowered into a sort of slot when the gate is closed.—ROY W. MARSH.

Patching a Water Tank

The method illustrated may be used to repair a leak. The hole is drilled larger, if necessary, and given a rectangular shape with a file. Then the head of a common machine bolt is filed flat, slipped through the slot, and given a quarter turn. A leather washer is slipped on the bolt, followed by a steel washer and a nut, which is screwed up tight.—J. H. S.



A water tank repair

Windows in a Partition

The handy man sometimes has the task of inserting a small window in an interior partition, which involves quite a bit of work if a neat job is to be done.

Recently I had to put two such windows in a newly erected wooden partition in order to allow more light to reach the

cellar stairs. Looking around for material, I found two discarded picture frames of about the right size. After cutting openings in the partition to take the frames, I removed the glass from them and fastened them in place with nails. A small molding was added to conceal the joints. Then the glass was replaced and held with light strips of wood.

Another way to have utilized the frames would have been to cut the openings in the partition to agree with the inside measurements of the frames and nail them flat against the wall. Either method insures neat looking windows at little or no cost.—W. L. L.

Removing Rust

A SIMPLE and effective way to remove rust from small and delicate objects is by electrolysis. Obtain a large bowl, enamel or glassware. Fill this with enough water to cover the object to be treated. Attach about two feet of iron wire to a block of zinc, and to the other end of the wire attach the object from which the rust is to be removed. Make sure that good electrical contacts are secured in each case. Immerse both iron and zinc in the water, but allow the iron wire to appear above the surface of the water. Now add about ten percent of sulphuric acid to the water, the exact proportion is unimportant.

WATER—80 PERCENT
SULPHURIC ACID—10 PERCENT



IRON TO BE TREATED ENAMELED BOWL

Hydrogen gas will be given off from the zinc with vigorous bubbling, while smaller quantities of gas will appear rising from the iron object. The process usually will take two or three hours longer if the rusting is deep. Gentle brushing with a steel wire brush will help.

When the rust has all gone, rinse thoroughly under running water, and dry quickly. Petroleum, oil, celluloid varnish or something similar should then be applied to prevent the reappearance of the rust.—DOUGLAS LEECHMAN.

Redeeming a Garage

LAST year I built a one-car garage, with a wood siding finish and a peaked shingled roof. In the back wall of the garage, high under the peak, I placed a single window of the cellar sash type, for ventilation and light. As a ventilator it was ideally located, but from the exterior it made the garage look extremely high and unattractive.

I solved the difficulty by building an 8 ft. trellis, about 2-1/2 ft. wide, consisting of four uprights and horizontal members spaced so as to divide the open spaces roughly into squares. Just above the center I cut out

(Continued on page 97)

The Shipshape Home

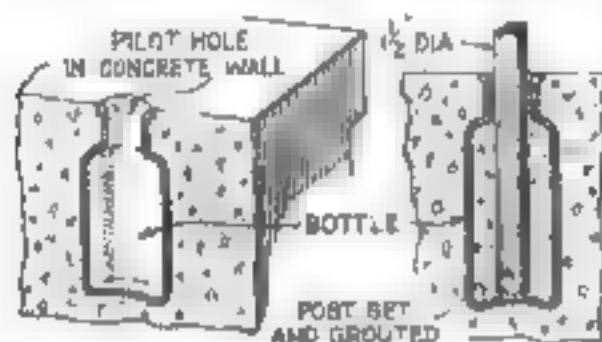
(Continued from page 95)

the inner two upright members and placed a flat diamond shape.

Now the eye no longer travels upward to the window as the only detail breaking the flat wall space, but centers pleasingly on the diamond shape in the trellis. And somehow the roof seems closer to the ground, and the wall seems just part of the picture, instead of thrusting itself to unpleasant heights. A rambler rose completes the picture.—J. F. HARDECKER

Pilot Holes for Posts

When erecting guardrails for fences where pipe fittings are to be used and the posts are to be set in a concrete wall or floor, a rigid and workmanlike job may be made by placing wide-mouthed quart bottles in the cement to



Large bottles placed in concrete walls or floors to serve as pilot holes for iron guardrail posts.

form pilot holes. When the concrete has hardened, the posts are set in the bottles and grouted with cement.

Bottles usually may be obtained that will receive 1 1/2-in. pipe; if larger pipe is used, some of the concrete and glass around the top will have to be broken away.—J. A. MILLER

Preserving Brushes

When through painting, one is apt to put the brush away carelessly in turpentine, linseed oil, kerosene or "thinner" only to find, when it is necessary to use the brush again, that the liquid has evaporated and the brush is as hard as a rock.

Here is the missing step in preserving brushes: Take a piece of sheet rubber—it may be a piece of discarded swimming cap, a toy balloon, or an old inner tube. Pierce a small hole for the brush handle. Tie it tightly over the top of a glass jar or can as shown in the illustration. The preserving liquid will not evaporate so quickly and when you go back to use your brush, it will be soft and pliable.—J. L. JONES



Rubber cover for brush jar or can.

Before cutting a large sheet of common window glass, look along the edges to see which face of the glass is convex. This side should be turned down on the table.



What Sport!

What Fun!

-with these two famous Indian "pals"

Less than **1¢** a mile

At set, fellows? Here's how! For healthful outdoor sport—for comfortable travel at less than carfare—for getting quickly to business or pleasure—an Indian's your best "pal" every time!

Try either model, the Prince or the Scout. Smooth, quiet, powerful—safe! Easily handled and as dependable as your best friend. Takes you anywhere, anytime, at a fraction of carfare cost—only a cent a mile or less. Team up with an Indian—now—and know the real meaning of motoring joy!

Easy to Own

Call on your nearest Indian dealer. Let him demonstrate the Indian Prince and the Indian Scout—the two "pals" that cut the heart out of travel cost. Let him tell you about the easy pay-as-you-ride plan that enables anyone to own an Indian. The coupon below brings you—free—our illustrated catalog. Mail it today for the complete interesting story of these two famous models.

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A few good territories still open. Real opportunity for ambitious men. Write now!

Indian Motorcycle Co.

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SPRINGFIELD MASS.

Check nearest age to help us suggest the model for your requirements

THE INDIAN PRINCE The Solo Single

Learn to ride in 5 minutes. Clanks disappear in 10. 33 in. high. Speeds to 50 miles per hour. Low engine. 3-speed transmission. Two-spoke steering system. Light a steady 90 miles per gallon. Less than 1¢ per mile operating cost. Price with complete electrical equipment \$295. F. O. B. Springfield, Mass.

INDIAN SCOUT The Solo Twin

Twin cylinder smoothness, acceleration and power combined with lightweight low saddle case—handling 65 miles per gallon. 1¢ per mile. Highest used-value. Thousands delivered 7 years ago in use today. Price with complete electrical equipment \$395. F. O. B. Springfield, Mass.

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Lowest initial cost!
Lowest upkeep!
No garage bills!
No traffic delay!

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☐ Send me your illustrated Catalog describing the Prince and the Scout.

☐ Check box square if you are interested in our money-making proposition to dealers.

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**IF YOU CAN USE AN
EXTRA \$20.00 BILL**

write for
this

**FREE
BOOK**

YOU can save
\$20.00 in no
time by using



SMOOTH-ON No. 1

to do your own household repairing—and in addition you will have that proud "I-did-it-myself" feeling.

Here is what one enthusiast did with two 15 cent cans:—A \$25 lamp stand loose in base, two big leaks in heating furnace smoke pipe, loose hammer handle, and three loose hooks in tiled bath room wall were all put into good usable condition at an average cost of 10 cts. for each repair—and \$20.00 easily saved over what would have been paid to professional fixers or for new parts.

By using Smooth-On to make dozens of the simple repairs necessary in every home, you can save enough to pay your radio upkeep, buy yourself or your wife a camera, a bulb pump or some other pleasure giving article that you would otherwise have to spend the money for.

On the Automobile

Smooth-On No. 1, being unaffected by water, oil, gasoline or heat, is also excellent for automobile repairs. Try it for stopping radiator, tank, pipe line and hose connection leaks from the outside, keeping exhaust line connections tight to prevent the escape of obnoxious burnt gases, repairing cracked water jackets and crank, gear and differential cases, keeping grease cups, lubricator connections, nuts and hub caps from loosening and falling off, tightening loose hinges, robe rails, etc.

The FREE Smooth-On Repair Book

will show you how an astonishing number of home and automobile repairs are as easy for you to make as for somebody else.

Mail the coupon for a free copy and get Smooth-On No. 1 in 7-oz. or 1 or 5-lb. can from any hardware store.



Smooth-On Mfg. Co.

Dept. 58, 574 Communipaw Ave.,
JERSEY CITY, N. J.

Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 58,
574 Communipaw Ave., Jersey City, N. J.

Please send the free Smooth-On Repair Book.

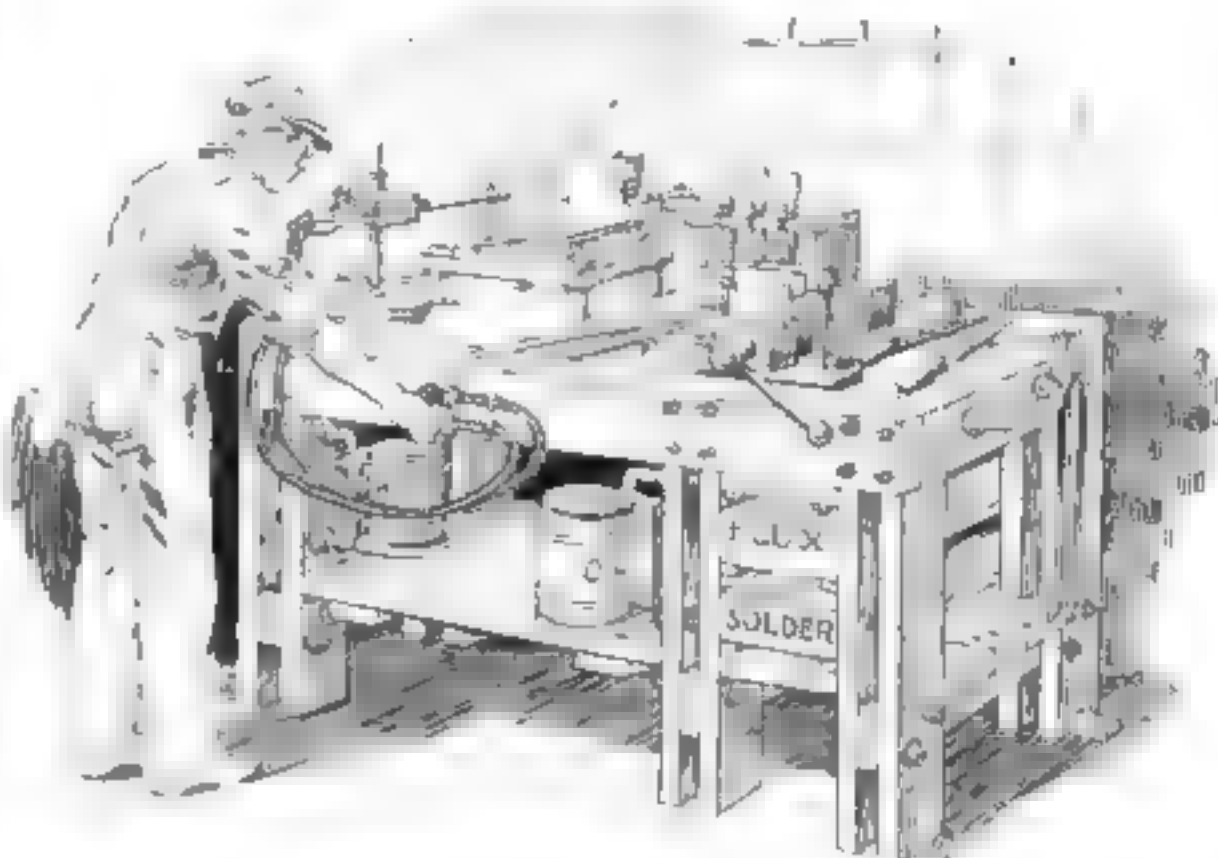
Name _____

Address _____

**Return this coupon for a
FREE copy of Booklet**

Bench for Small Soldering and Hardening Jobs

By HENRY S. LARABY



The bench contains a stand for the blowtorch, a furnace, a pilot gas flame, swinging oil and water tanks, drawers for holding soldering supplies, a file rack, a holder for tongs, and other equipment.

OLD MAN WILSON was so absorbed in watching the flame in his new "hearth" that he did not notice the shadow cast by a visitor. "What in the world is this you have?" his visitor asked.

Wilson, although somewhat startled, kept his hand on the gas control to the torch as he looked around. He grinned in recognizing his friend.

"This is my new toy," he said with the same pride he would have shown in mentioning a new car.

"Well, it looks as if all the playthings are right at hand!"

"Certainly! That is what I wanted. We have needed something like this for a long time, so finally I got the lumber and had one of the apprentices build the bench in odd times. We had most of the equipment about the place. How do you like it?"

"Seems convenient for such work as tempering and soldering."

"You are a good guesser," Wilson returned. "We call it the 'blow torch bench,' but it is really a hardening and soldering outfit. See, we put it where

there is good light, gave it a sheet iron top, and built a little furnace at the correct height to save stooping. Oil and water are in buckets arranged to swing out of the way, so they won't be kicked, and there are drawers for solder and flux, and the like.

"The gas torch is mounted on a stand so that we can adjust it to heat anything we can put in the furnace, or we can use the torch to heat work held in the vise. The furnace has a hole in the top for soldering irons, and the fumes go out the same hole instead of blowing back in your face. There is a pilot flame going all the time so it takes no time to light the torch."

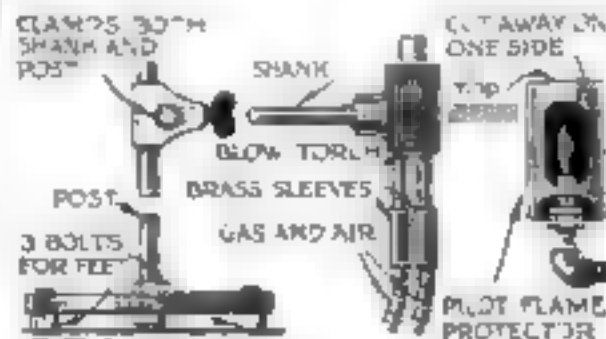
"I have been wondering if some such arrangement would not fit in well in my basement at home?"

"Sure thing," Wilson replied. "The whole thing is made of two by sixes put together with bolts and lag screws. You would not have compressed air as we have, but you could get a satisfactory kerosene burner for small work. A combination like this would be fine for any sort of shop, large or small."

"It certainly looks good," the visitor agreed.

Drilling Very Hard Steel

TO DRILL a piece of very hard steel, even when tempered, try the following if other methods have failed: Take a carbon steel drill, grind as required, heat to a bright red, dip in powdered rosin about five seconds, and then plunge into a water bath. Use turpentine for a coolant. I have found that this will do the work four times out of five. H. J. C.



Details of standard and clamp for supporting the blowtorch, construction of the pilot burner.

Old Bill says—



ENGINEERS and machine designers often can save money for their firms by getting acquainted with the shop force.

The man in the shop is in a position to see where time or materials may be saved, sometimes by a trifling change in the design of a part.

Lathe spindles have a peculiar tendency to wear out of round because of the pressure of the cutting tool on one side; this is noticeable when a hole that has been bored to close measurement is found to be out of round and tapered.

A worn lathe spindle usually will bore holes that are tapered with the front end large.

Poor work may result also from the wearing of the carriage ways.

Never pass by any evidence of danger or accident without correcting or reporting it; your own life and the lives of others may be at stake.

A good machinist is always a careful workman.

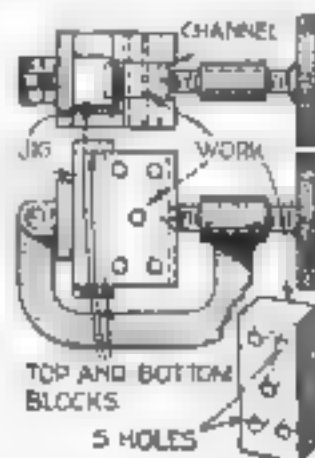
Automatic lathes have taken a lot of work away from the engine lathe, but after all the engine lathe is the most economical all-around machine for general work.

Equipped with a few inexpensive accessories, a lathe sometimes can compete as a production machine with high priced special machines that are of no use for other work.

A gage should never be forced to obtain a fit.

Do every job as quickly as you can, but don't forget quality in your eagerness to pass on to the next job.

Quick-Acting Hinged Jig



A jig for drilling

FOR drilling five holes in the small block, a hinged drill jig was devised as illustrated. The work fits in a channel section that is provided with guide holes and is clamped with two knurled screws. The jig is swung open for cleaning and loading. — FRANK N. COAKLEY



The Radiophone's Meaning

An Advertisement of the American Telephone and Telegraph Company



AN ADVENTURE in communication was made last January when transatlantic radio telephone service was established between New York and London. There had been previous tests and demonstrations. Nevertheless, the fact that at certain hours daily this service was made available to anyone in these cities from his own telephone, created such public interest that for several days the demands for overseas connections exceeded the capacity of the service.

It was then demonstrated that there was a real use for telephone communication between the world's two greatest cities. It was further demon-

strated that the American Telephone and Telegraph Company, with the co-operation of the British Post Office, was able to give excellent transmission of speech under ordinary atmospheric conditions.

In accord with announcements made at that time, there will be a continued effort to improve the service, extend it to greater areas and insure a greater degree of privacy.

It is true that static will at times cause breaks in the ether circuit, but a long step forward has been made towards international telephone communication and more intimate relationship between the United States and Great Britain.

Make More Money Read the Money Making Opportunities on pages 116 to 143 of this issue.

Let Boice Help You Build It!

Men everywhere are finding it easy to build a new Boice-Crane Bench Lathe and bank of working drawers. Read the full story of this new machine in the money making section of this issue which contains many other money making ideas. Also gives list of banks and money making opportunities.

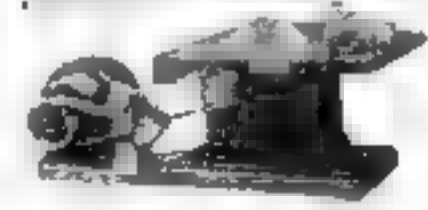


14" Band Saw
Table 12" x 14"
Saw 14" d x 14"
Saw 14" d x 14"
Saw 14" d x 14"
Saw 14" d x 14"
Saw 14" d x 14"
Saw 14" d x 14"
Saw 14" d x 14"



8" Bench Lathe
Does turning, drilling, broaching, sanding, grinding and is set up in 10 min. or less. No. 14. Capacity 10" between centers.

Junior Saw
Does ripping, mitering, grooving, sanding, grinding and drilling with ease and accuracy. Table 10" x 13". Saw 14" d x 14". No. 14. Capacity 10" between centers.



All Boice Machines drive by 1/2 to 1/4 hp motor attached to light motor. Send for booklet today! 7007

W. B. & J. E. BOICE Dept. P. S. 3-C Toledo, Ohio

Tongs with Wide Jaws for Handling Axles



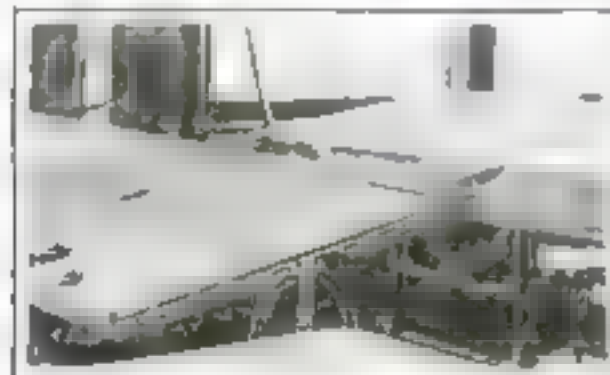
The tongs are prepared by welding curved sections of old boiler plate to the jaws.

TWO 8 by 8 in. sections of old boiler plate, welded on the jaws of tongs which are suspended from a regular air hoist, make it easier to handle heavy journals in a Denver wheel shop. The sections of plate are curved to fit the journals. They are more quickly adjusted and give a much better control of the work than other devices that were previously used.—JOSEPH C. COYLE.

Window Shade Used As Cover for Drawing Board

EVERYONE who has left a drawing board overnight knows how disagreeable it is to return the following day and find the drawing covered with dust and dirt. Sometimes a loose cloth is put over the table but that is likely to blow off, or to carry instruments with it when taken off.

A good scheme for protecting the board and tools is shown in the accompanying



Window shades are mounted on these drawing boards so that they can be covered quickly.

illustration. A window shade roller is fitted to the back of the board so that the shade may be pulled over the drawing. It is readily rolled out of the way, and if the front end is lifted about a foot from the board, it will roll up without disturbing drafting instruments, reference sheets or anything that may be on the board.—ALBERT E. GRANVILLE.

INITIALS and figures may be etched neatly on steel with the aid of a rubber stamp. Apply asphaltum varnish to the steel and allow it to become somewhat hardened, so that when the stamp is pressed against it, clean cut lettering will be imprinted right through it to the steel. Then apply an etching fluid with a medicine dropper.

9'x3' Back Geared—Screw Cutting SOUTH BEND BENCH LATHE

\$150



Attachments

Model	Price
Standard	\$150
Junior	\$100
Miniature	\$75
Toy	\$50

A South Bend Lathe for Every Job

There is a South Bend Lathe for every job. The South Bend Lathe is the most popular lathe in the world.

Model	Price
Standard	\$150
Junior	\$100
Miniature	\$75
Toy	\$50

Easy Payment Plan if Desired



Price Includes Counter shaft and Equipment

Brief Specifications:

Feature	Specification
Spindle	1 1/2" diameter
Bed	9' x 3"
Headstock	Cast steel
Tailstock	Cast steel
Tool rest	Cast steel
Lathe dog	Cast steel
Lathe dog screw	Cast steel
Lathe dog nut	Cast steel
Lathe dog pin	Cast steel
Lathe dog block	Cast steel
Lathe dog bracket	Cast steel
Lathe dog clamp	Cast steel
Lathe dog screw	Cast steel
Lathe dog nut	Cast steel
Lathe dog pin	Cast steel
Lathe dog block	Cast steel
Lathe dog bracket	Cast steel
Lathe dog clamp	Cast steel

SOUTH BEND LATHE WORKS
833 E. Madison St. South Bend, Indiana

A Claw-Hammer and Cutting Tool in One

THE chisel edge on the end of the claw makes this hammer a cutting tool of a hundred uses, without a losing the claw feature. Small side claws make it easy to pull nails in close corners. The offset position of the head gives far greater leverage—pulling ten pennys a law with ease. A perfect balance between hammer and cutting tool. Forged of tool steel. If your dealer cannot supply you write us direct.

Price \$2.00

CHISEL-EDGE-CLAW HAMMER COMPANY
R. A. Ayres—Dept. E
Hoboken, N. J., U.S.A.

PARKS

WOODWORKING MACHINES

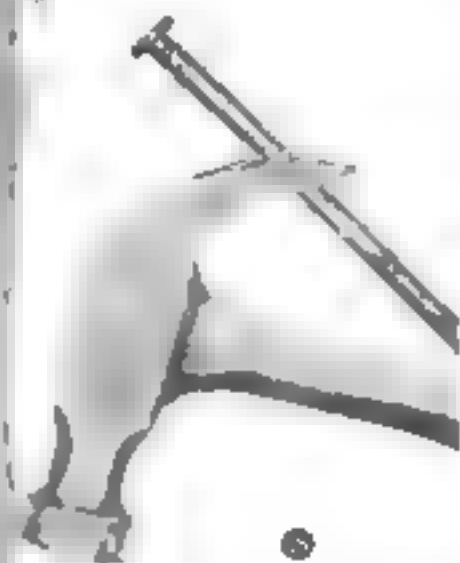
Cabinet Shop Special No. 10 \$290 with Motor

You ought to have this handy Parks in your shop. It is a compact, complete machine designed just like a big production outfit at one-fifth the cost. Includes 8-inch circular rip and cross cut saw with polished cast-steel saw table, 16-inch band saw with tilting table for bevel sawing, 6-inch jointer, and motor operating from any light socket. Just plug in and go to work! Fits in a corner of your basement. Does any kind of cabinet and joinery work. Add lathe, shaper and other attachments any time at small cost. For the man who does "odd jobs" in his off time this Parks is a big money maker. Turn out as much as a four-man shop working by yourself.

Write for circular and Parks complete catalog of handy woodworking machinery

The Parks Ball Bearing Machine Co.
1547 Kewlton Street, Cincinnati, Ohio
Canadian Factory: 208 Notre Dame East, Montreal, Can.

Can't Break or Loosen

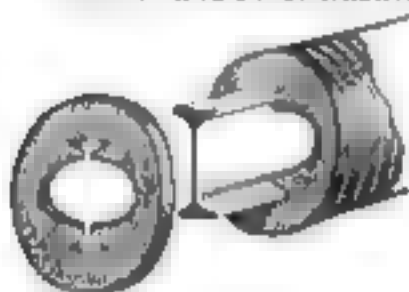


Prove this Yourself

Bite into and pull the head or clench of a 60d spike or pin thru a 4 inch plank.

FORGED in ONE PIECE

of Fine Tool Steel, Grip of Boile Leather Washers, pressed and riveted between the shoulder and steel washer.



Estwing "Unbreakable" are the New Era Patented Tools.

1. Adopted by the carpenters.
2. Used by large industries where all others failed.
3. Approved by university and wholesalers laboratories.
4. Have Unbreakable strength.
5. Easier and surer drive.
6. Finest grip and feel.
7. Unsurpassed temper.
8. Weather proofed, absolutely.
9. Appearance as superior as quality.
10. Unheard of value for their price.

Guaranteed "UNBREAKABLE"
by our "Free Replacement" Tag and
SUPERIOR IN EVERY WAY

we refund your money.

Using Estwing "Unbreakable" is Leadership

Show this to your dealer. He will be pleased to serve you. Or send money with order. Include 15c extra for each tool ordered which pays postage, or pay mail bill.

Curved Claw Hammer, 12 oz. Head	\$1.00
" " " 16 " "	1.00
" " " 20 " "	1.25
Straight " " 12 " "	1.00
" " " 16 " "	1.00
" " " 20 " "	1.25
Half Hatchet No. 2 Smooth Face	2.25
" " " Scored	2.25
Util-ax, 28 oz. with Leather Sheath	2.25
Scout Ax, 24 oz.	2.00

ESTWING MFG CO., Rockford, Ill.

A Job for One in a Million

(Continued from page 18)

cracked motor and were lost for four days in the Everglades. Their only companions were rattlesnakes and vast swarms of mosquitoes. All that stood between them and starvation were a few bars of chocolate and two cans of beans. Finally they were found and rescued by one of a number of airplanes sent out to search for them.

LAST year Smith again was in the tropics engaged, with T. Glass as pilot, in photographing territory in the vicinity of Tampico, Mexico. They were flying low over bushy country where bandits had been reported, when they suddenly were made the target for pot shots below. All at once they felt the plane shiver, and they knew it had been hit.

Glass completely cut off the motor and glided down, and no sooner had they landed than a dozen armed bandits rushed toward them. The airmen, unarmed and powerless, thought they were done for. The Mexicans, however, were immediately struck by the strange instrument which the fliers seemed to guard so carefully, and crowded around the camera in childish curiosity. Glass, who could speak a little Spanish, tried to explain that they were merely photographing the territory for a Mexican company. Both men, however, were held prisoners for several days before negotiations with the bandits brought about their release.

The experiences of Major Hamilton Maxwell in making close-up photographs of Niagara Falls and the Gorge in July, 1920, illustrate how iron nerve alone sometimes carries the photographer through a ticklish job in the face of danger. From the moment he and Ford McCarthy, the pilot, took off from a small field on the Canadian side, the thrills began.

"THE field was much too small for our plane to get out of with the heavy load we were carrying," said Major Maxwell, describing the trip. "To clear it, we had to zoom over some seventy thousand volts in power wires at the far end. These wires were forty feet up, and we didn't leave the ground until we were about fifty yards away from them. Never will I forget my feeling of relief when I looked back to see the tail skid clearing the last wire by about one inch."

"Such a beginning left me none too calm for the job I had undertaken. However, we had to get the photographs. And then, when we flew down close to the falls, we ran into violent bumps, the like of which I have never felt before or since. We were drenched with spray. I became violently ill. To make matters worse, McCarthy, in his zeal to get me in position for the photos, made the old ship do Immelmann turns and nearly every other flying trick during the twenty-five minutes we were there. The last straw was when McCarthy decided to finish up the job by flying under the Suspension Bridge. The rest of the trip was virtually a blank, until I found myself lying on my back at the flying field in

Buffalo. But I got my photographs, one hundred and forty of them."

In Uncle Sam's Navy is one old-timer who has survived a dozen close calls, not the least of which was an almost miraculous escape in the Shenandoah disaster. He is Lieut. W. L. Richardson, chief photographer for the Bureau of Aeronautics. When the Ohio storm sent the "Daughter of the Stars" to her doom, Richardson managed to cling to the careening wreck until it crashed to the ground. Then, his right ankle caught in a wire, he was dragged downhill underneath the ship. Only by rare luck did he survive.

AT ANOTHER time Richardson went aboard the dirigible *Los Angeles* to take charge of naval photographers detailed to make photos of the solar eclipse of January, 1925. And at what risk! Mounting cameras on top of the dirigible, Richardson and another photographer, Peterson, calmly took still and motion pictures at a height of 8,000 feet, and at a temperature far below zero. Their faces were frozen, but they stuck to the job.

Another world famous air photographer is Captain A. W. Stevens of the Army. Perhaps his greatest exploit was the history-making flight of 1924 when, in a plane piloted by Lieut. J. A. Macready, he photographed the city of Dayton, O., from an altitude of 31,500 feet, or nearly six miles, which at that time was a two-man world record. One photograph covered an area of nineteen square miles and included almost the entire city of Dayton.

Less than a year later, Captain Stevens, as a member of the Alexander Hamilton Rice expedition into the jungles of Brazil, risked his life in a flying boat to take photographs of territory never before seen by white men. With Lieut. Walter Hinton, who piloted the Navy plane, NC-4, across the Atlantic as pilot, he penetrated 120 miles farther into the dense jungles than any other explorer ever had gone. Traveling light, neither man carried any firearms. A machete and an ax were their only weapons in case of a forced landing, and these would have been almost useless against the poisoned arrows of the savage tribes which infested the region.

THESE are typical of the kind of men who are following the fascinating new profession in increasing numbers. Yet none of them are foolhardy adventurers. To them the science of mapping the earth from the sky is a real man's job. Most of them are married, and many of them are rearing families.

This summer, undoubtedly, there will be trans-Atlantic flights between New York and Paris; perhaps a flight around the world for a speed record. Certainly there will be more expeditions into the Far North. And you may be sure that plenty of camera men will be applying for places in every one of these expeditions.

Tishy

(Continued from page 10)

longer wait, with slow, careful turning of the sextant tangent screw. Then Tishy did an amazing thing. He leaned against the rail, stared upward at the bridge, where Debron stood peering out at the lightship through the dim blackness, and laughed quietly.

"LET him find out. It's a man's job!" he muttered, and again tried for the star, got it, and went below to work out the position from the result.

When he got the position line ready from his observation, Tishy smoked a cigarette before going to the chart room to lay it down on the chart. Debron, of course, had a line, too, but since he had picked up the light he would probably not be in any hurry about laying it down. Through the darkness astern the light of the windjammer blinked fitfully. Windjammers were never famous for the quantity of their lamp oil. There was a whine in the air, although the snow had stopped, and the running seas over-ride had a queerly vicious look as they curled along the black steel hull. Tishy threw the cigarette butt over the side and started toward the chart room. Passing the bridge ladder he heard the captain's voice above.

"That lightship is adrift! Stop the ship and take a bearing."

Tishy went inside smiling. He had seen that the lightship was adrift. Debron had not. The Old Man had found it out. That would fix Debron. The big, cocksure fellow would hear all about it in the morning. It was a good thing the passengers were all asleep. There would be nothing to worry about, since he, Tishy, had a fix which would at least help to place the ship. But when he laid off the position line on the chart, Tishy lost his smile. He stepped outside quickly, sought for the light, and could not find it. Instead, there was a small light such as an anchored vessel shows on her forestay. The lightship's people had discovered they were adrift. And almost at the moment when Tishy discovered that small light, there was a shout from aft, that the momentarily forgotten windjammer in tow was close under the stern, unable to stop when the steamer—unstopped for the bearing. That old wreck, down by the head with ice, was simply unable to sheer clear once the pull of the towline let up.

"Slow ahead port. Helm-a-port," the captain ordered, and the big steamer began to move in a short arc. Then the lookout in the foremast crow's nest, ignoring the speaking tube in his excitement, yelled:

"Breakers ahead and to port!"

TISHY was at the bridge ladder. He felt grilly. He had never meant to let Debron get into quite that fix.

"Hard a-port! Full ahead port engine, half ahead starboard," the captain cried, anxiously, peering out into the blackness where a venomous white line seemed suddenly to stretch away.

The steamer forged ahead, gathering speed.

"Look out aft, there."

The towline twanged tight. It snapped where the ice of the windjammer's bows cut it. The shock of the breaking wire was felt forward, but not nearly so tremendously as was the following shock when the wire fouled the steamer's propellers as she turned.

The terrific jar shook the steamer. Officers' doors opened. That rattling crash would awaken the Seven Sleepers. The helmsman in the wheelhouse said, in a cool, duty tone:

"She won't steer, sir."

"Quartermaster! Call the chief officer," the master said. Tishy was at his side. "Get an anchor down quickly! Have the other clear. Debron, see all hands are called. Stewards too. Got to keep the" (Continued on page 106)

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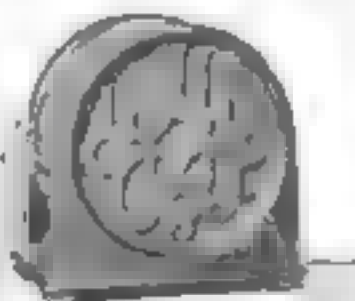


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BURGESS RADIO BATTERIES

Tishy

(Continued from page 105)

passengers from going batty. See what the tow is doing, quartermaster.

In the glare of great cargo nets quickly fixed and lighted, the scene was revealed as in starkest daylight. Tishy and his gang forward, letting go an anchor. The lightship, its riding light flickering, anchored well clear of the breakers. The windjammer swinging along with her head lowered down under her burden of ice, perilously close to the *Dudon*, nearer yet to the menace of the reef, her forlorn crew futilely attempting to chop the ice from her forecastle beam to get at her anchors before she went utterly to wreck. Sparks, in his little shack, seen through the open door, calling, calling, through the ether for assistance. A blinker lamp on the lightship telling the windjammer to anchor and an old man on the windjammer waving his arms in picturesque appreciation of the irony. Decks rapidly filling with frightened passengers, awakened by the crash of the lost propellers, and sent into a mild panic by the sudden terrific rolling of the steamer as she turned to the sea. Stewards going among them, assuring them that there was no danger. Many passengers accepting that assurance. Three hundred terrified steerage people refusing to believe, making a noisy rush for the boat deck, rebuilding their nose in the glare of the great arc lamps.

TISHY doubled aft when the anchor definitely held and the steamer stopped drifting. He could take in every bit of the scene. It was no comfort to him. How well he could see that all of it was up to him! Had he not been so litter, he would have told Debron that the lightship was adrift the moment he saw it by his sextant angle of the moving light with a fixed star. Then the course could have been altered without fuss; the tow would not have moved up, slackening the line; the towline would not have snapped without that abrupt shock of tightening again. The steamer would not have lost her propellers, nor need that old windjammer, with her stubborn old man and contemptuous crew, be at that moment drifting fast to destruction in the breakers.

As he recalled it all, a savage anger seethed through him. For that moment at least he justified himself blaming Debron. If Debron had not been so officious about that lifeboat job, if Debron had never been so damned patronizing if Debron had not been so clever with his nicknames—Tishy plowed through a swarming mob of steerage folks, all screaming and fighting about the boats, refusing to listen to the stewards or seamen. Tishy seized hold of the first one he collided with.

"Speak English!" he yelled. The man answered in a mouthful of gutturals. Tishy tried another. He tried many, then a man answered with a stomachy, rumbling "Yes."

"Then tell 'em the ship's anchored, that they're safe. Go on, shout it out before somebody's killed."

THE man bawled the assurance. There was something magical in the mere word, "anchored." Others took it up. Soon the mob roar was leavened with voices preaching security. A few refused to believe. Some yelled about the forward boat, and as he fought his way through, to get to the bridge ladder, Tishy saw Blanche Torrey and her father pressed against the rail. The girl was pale faced, but holding a brave front. The old fellow seemed to have shed his invalid's role in the emergency and was doing his poor best to protect his daughter.

"Oh, here's Mr. Burton, father! He'll look after us," the girl cried, and Tishy felt the hot blush flooding his face. What a fine protector he had shown himself to be! Even that old colored, age, weakness. *(Continued on page 107)*



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Tishy

(Continued from page 106)

The wind chopped the words, but the megaphone made clear something about a man needing medical aid; and the tug skipper shouted that he would run alongside if the man could be taken quickly. So men stood by. With a crash and a grinding the tug and steamer came together. For an instant the lights flooded both decks with stronger than daylight radiance. Strong hands passed over a bundle of blankets. Mouth shapes clambered over the rail after the bundle, and the tug sheered off to get her lines ready. Then it was that Blanche Torrey, in the salon, heard that which snatched her out of the colonel's arms and sent her on deck with signals flying in her cheeks.

"Three cheers for Tishy!" That was in Debron's voice, a bit shaky. And two hundred seamen, and five hundred passengers, gave tongue. A crowd followed the bundle of blankets, carried along to the doctor's quarters. The captain went inside Debron ton. And Debron sketched the story of searching for and finding Tishy exhausted, so far to leeward that the boat could make no headway back. Of sight up the lights of the tug, and of being picked up out of a sinking boat at last.

"The little chap's pretty badly frozen, sir," said Debron. "Plucky little devil!"

"All right. Go and look after the towline and stand by to get your anchor. Tell the third mate to look out aft. And as Debron left, with a peg of the doctor's whiskey still stinging his palate, the captain found a slim, trembling girl trying to thrust past him to the surgery.

"Can't go in there, now."

"Oh, but I'm a good nurse, captain. Please, doctor!"

The doctor knew enough about the Torreys to be sure that Blanche was a good nurse. Tishy would need a good nurse before he regained his state of normal entirety and well-being. He nodded, and the captain gave way.

It was a half-frozen, bruised, sorely frozen Tishy that at last opened his eyes to see who possessed the curving hand that so eased his agonies. The pained eyes closed again after one swift gleam of happy recognition. If Tishy heard any of the many voices that murmured inquiries near by, he gave no sign. When Debron called him "Tishy," Tishy's eyes opened for an instant and smiled. There was something of baggage belloyed in the way Debron uttered that Tishy, now it sounded like the hull mark of folk-ship.

Besides, his other hand, the one least badly injured, was held in the warm grasp of tender fingers that in themselves eradicated any trace of bitterness left.

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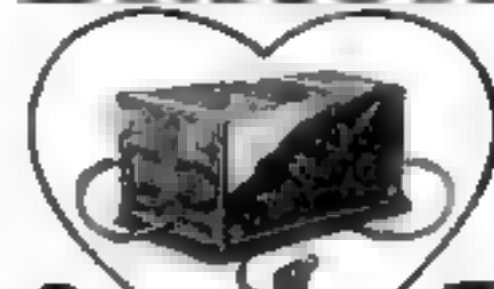


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Bare Hands

(Continued from page 110)

charcoal on fire and pump our bellows as fast as we can to create a strong draft. The charcoal separates the iron from the ore and it melts and runs down to the hearth. Other things melt and run down, too, but they are lighter than the iron and so float on it, and we let them run off through the upper one of those two holes. The lower hole is at the level of the hearth, and that will be kept plugged until the molten iron has collected. Then the plug will be removed to let the iron run out. I've made a place for it to run in the sand. Then these holes in the sand are molds. The iron will flow into them and will cool and solidify in those shapes I have worked out.

"What are they?"

"The first is a large hammer," replied Thornton. "The second is a smaller hammer, and the third is a rough axe blade. The fourth is an axe."

"What kind of iron will you get?" asked Williams.

"THAT is the question," jeered Parker. "You may not get any. On the other hand, you may get stuff with so many impurities in it that it will be worthless. That is probably what will happen. Your furnace is crude, your air pressure is limited, and you have no accurate method of assaying your ore or of measuring anything else. The various grades of iron and steel depend upon the percentage of carbon they contain. If you should get iron with less than three tenths of one percent—which is impossible—it would be malleable iron, and carbon would have to be put in it before it would become hard enough to be useful for edged tools. If you should get metal with from three tenths of one percent to two and two tenths percent of carbon—which, because your furnace is so small is conceivable but not likely—it would be steel, and that would be nice. If, however, the metal contains more carbon than this latter amount it is cast iron, and as such will be more or less useless. Unless, of course," he sneered, "you can erect a Bessemer converter."

"Or a puddling furnace," added Thornton. "That's simple enough, and we could remove the excess carbon, and make steel or malleable iron."

Parker snorted.

"You presuppose," he argued, "that your metal will be largely free of other impurities, and that's impossible."

"Then are we all ready to go?" asked Kelly.

"ALL set," nodded Thornton. "You and Williams just sit up the ore, while I get the kindling ready. He bustled himself with a pile of sticks. Now put in some charcoal—that's the stuff. Now ore. Now charcoal. He pauses, while they dumped the materials in. "Now more ore. That's it. She's full and we're ready."

He took a burning brand from their camp fire, thrust it through the cinder notch, and saw the kindling catch fire. It burned up slowly, and he began to pump two of the bellows—one with each hand.

"Get busy," he shouted, "and work your bellows. The experiment is on."

Parker stood idly by. He merely watched as the others labored. The bellows thumped up and down and the furnace grew hotter and hotter. Flames shot out the top, and the perspiring group pumped like mad. For half an hour they worked the rusty skins up and down, and finally Thornton, who crouched near the cinder notch, saw a glowing residue reach the opening and slowly break over the top.

"Pump!" he shouted. "Pump!"

He paused to take off his rabbit skin coat, and went to work again with renewed vigor.

"More charcoal and" (Continued on page 112)

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Glenn Curtiss

(Continued from page 113)

to experiment at Baddeck with tetrahedral kites and with aerial propellers on boats, and then Curtiss went back to Hammondsport to prepare for the continuance of the experiment. He was "sold" on mechanical flight by this time, but was still making dirigibles.

Not long after Curtiss' return to Hammondsport, Augustus Post, Secretary of the Aero Club of America, was in his office when a telegram came from Professor Bell. "Start building," it read. "The boys will be down next week."

"That was like Professor Bell," smiles Curtiss remissively. "We hadn't decided what to build or how to build it, but he wanted something built right away." Incidentally, he could not build anything himself. "I never saw a man less handy with tools. The simplest operation, even driving a screw with a screw driver, stumped him. But he had very concrete ideas about the way he wanted things done and a wonderful way of getting his ideas across to the man who had the mechanical skill to carry them out. He never 'bossed,' never scolded, never criticized, but somehow he kept other people on their toes all the time. He was a wonderful man."

CONTEMPLATING the telegram from Professor Bell and discussing it with Mr. Post, Glenn Curtiss decided that the way to get quick action was to build a glider, which could be constructed in a week and would provide occupation while the motor-driven plane was being built. So when McCurdy, "Casey" Baldwin and Lieutenant Selfridge joined him, there was a glider all ready, and all four of them practiced gliding from the hillside of Lake Keuka.

Selfridge was given the honor of approving the first plane. It was a biplane, with the wing structure covered with red silk, so it was named the *Red Wing*. Each member of the Association contributed ideas, but this was to be Selfridge's machine, and acceptance or rejection of the suggestions of the others rested solely with him. The *Red Wing* was finished, motor installed, everything ready for the "jump-off" early in 1908, but the icy north winds did not let up sufficiently to make the experiment until March 12th when, on a still but intensely cold day, the *Red Wing* made its first and last flight.

IT HAD been agreed to try it out on the first favorable day, whether Selfridge was there or not. When the day arrived, Selfridge had been called away on business, so it fell to "Casey" Baldwin to take the tiller, while the others started the engine by giving the propeller a whirl.

"There was a real thrill," said Curtiss. "The *Red Wing* was equipped with skids, as were the early Wright machines. It skated over the ice of Lake Keuka while we held our breaths, wondering if it would rise into the air. At last it did! We saw an airplane fly!"

The *Red Wing* rose nearly eight feet

into the air, traveled a distance of three hundred and eighteen feet, eleven inches, and then crashed, landing on one wing tip and wrecking the whole machine.

"It was about what we had expected," said Mr. Curtiss, "but we were jubilant. We knew now that we could build another machine that would fly higher and longer. We had spent seven weeks building the *Red Wing* and it had taken twenty minutes to smash it, but we had achieved a great thing—the first public flight of a heavier-than-air flying machine."

"CASEY" Baldwin took charge of the design of the next machine, the *White Wing*. The ice had broken up before it was finished, and its tests had to be made on an old race track near Hammondsport known as "Stony Brook Farm." There were crashes and disappointments galore, some short jumps, one or two flights almost as high and as far as the *Red Wing* had gone, rebuilding, repairing, changing the design, consulting with Professor Bell, who had come down from Nova Scotia to join his youngsters, and a tremendous disappointment when, after discarding the expensive silk for cheaper cotton for the wing covering, the machine refused to rise at all. This was puzzling, until Professor Bell pointed out that the porous cotton did not offer sufficient air resistance; so the wing covering was varnished, now the universal practice. On May 22, 1908, Glenn Curtiss took his seat in the *White Wing* and really flew!

One thousand and seventeen feet in nineteen seconds was the *White Wing's* record on this occasion. It rose high enough into the air to leave no doubt that it was really flying, high enough for the people of Hammondsport to see it over the race track fences. And it landed in a plowed field without damage.

"This was regarded as a remarkable flight and, naturally, I felt very much elated," said Mr. Curtiss. "There was no question, now, that we had found the right principle on which to base our further experiments. And we had proved to a skeptical world that mechanical flight was an actuality."

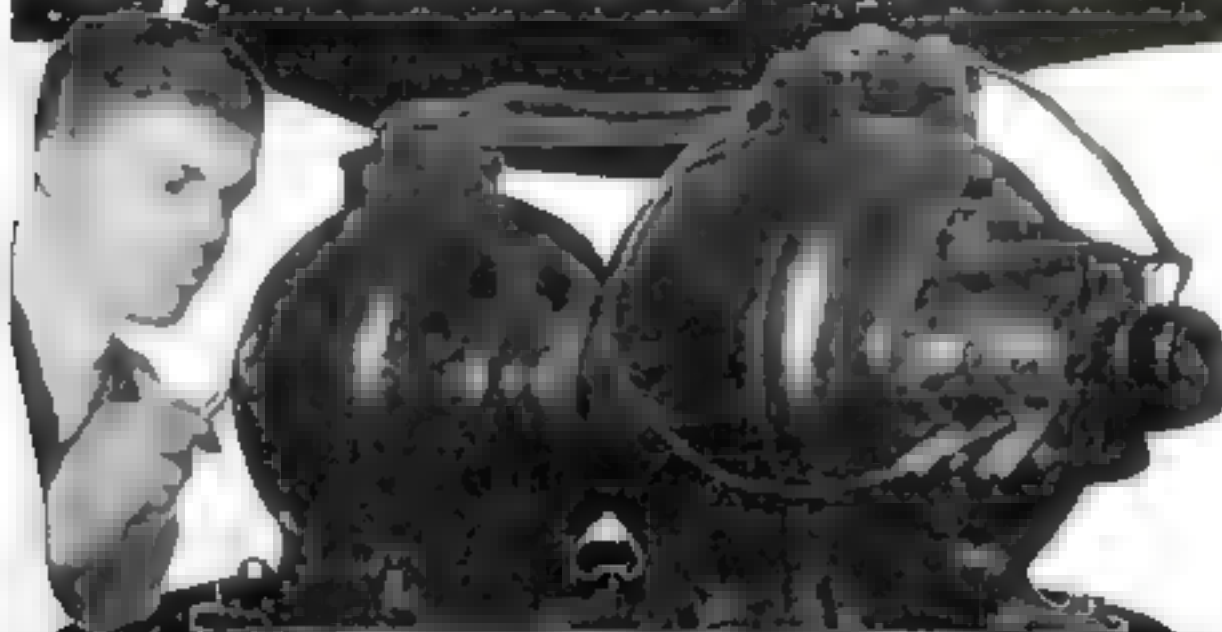
Now it became Curtiss' turn to take charge of the construction of the next machine, and work was started on the *June Bug*, in which Glenn Curtiss was to make, on the Fourth of July, the first previously-announced public flight ever made by any airman, and to win the Scientific American Trophy for the first flight of one kilometer or more.

In the next installment of this remarkable series, Mr. Stockbridge tells how Glenn Curtiss built and flew the *June Bug*, won the Scientific American Trophy, gave New York City its first sight of an airplane in flight and then went to France and captured new honors. This story is more than a chronicle of the career of one man; it reveals for the first time the fascinating details of the early history of aviation—facts hitherto known only to Curtiss and a few other pioneers.

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Yes, 3 months at the Great School of Coyne, located in Chicago, The Electrical Center of the World, will make you an Electrical Expert capable of commanding big pay. The whole world of electricity is open to the practical man, the man who has had actual experience with electrical apparatus. Coyne gives you a practical training on the greatest outlay of electrical apparatus of any institution in the World; everything from door bells to power plants.

Not a Correspondence School

We don't make you a mere "paper" electrician. We train you by practice on our mammoth outlay of actual equipment. We train you in house-wiring by having you do it exactly as it is done outside—not just by reading about it. The same applies to armature winding, power plant operating, motor installations, automotive work and hundreds of electrical jobs. That's why we can train you to become a Master Electrical Expert.

No Books—No Lessons—No Classes

You Do Actual Work

The Coyne practical course includes no books, printed lessons or useless theory. We train you to work with your head and hands on the same kind of electrical apparatus as you will find "out in the field." Age, lack of experience or education is no

drawback. Our students range from 16 to 60 years of age. Coyne gives you Free, a Life Scholarship which enables you to return at any time for instruction on new apparatus which we are continually adding to our course. We assist you to a position after graduation. Free Radio Course included.

Earn While You Learn!

We help students to secure jobs to earn a good part of their living expenses while studying.

Send Coupon Now

Send coupon today for big Free Book and full details of our special offer of Free Railroad Fare. Act now.

H. C. Lewis, Pres.

Founded 1889

COYNE

ELECTRICAL SCHOOL
 1209-1210 West Harrison St., Dept. 47-72
 CHICAGO ILL.

Free R.R. Fare

H. C. Lewis, Pres.

COYNE ELECTRICAL SCHOOL, Dept. 47-72,
 1209-1210 W. Harrison St., Chicago, Ill.

Dear Mr. Lewis: Please send me free your big catalog and your special offer of free railroad fare.

Name

Address

How Robert Hubbard Is Getting Ahead in the World

Every month hundreds of people tell us how they have used advertisements in POPULAR SCIENCE MONTHLY as stepping stones to success. This month Robert Hubbard wins the first prize for the best letter telling how success has been won through the use of opportunities offered by advertisers in POPULAR SCIENCE MONTHLY. Mr. Hubbard says:

Content Editor

The advertisement that interests me most in the "Money Making Opportunities" section of POPULAR SCIENCE MONTHLY for January is that of the American School.

Two years ago I was working in a big department store at \$18 a week with little hope of promotion. The oldest and best sales people on the same floor with me received \$25 a week.

For two years I studied hard at night and finished my course in business training which included the art of writing advertisements for big businesses. I am now doing the advertising of two of the biggest department stores in the city. My salary runs from \$20 to \$125 a week and I am not closely confined.

My advancement with big boost in earning capacity are due to my ambition and the training given me by the American School.

Courses are offered in electricity, drafting, automobile mechanics, business and high school branches, and any young man or woman who desires to rise above his environment can find what he needs in the American School.

ROBERT H. HUBBARD, Little Rock, Ark.

From \$18 a week to \$80 is the story told by E. J. Bennett whose letter wins the second prize.

Content Editor

I always had a talent for drawing and wanted to be a commercial artist, but there were seven other children in the family and money was scarce. However, I managed to finish high school by selling papers.

As I had to work, I took the first job offered me, a place in a grocery at \$18.00 per week. A long ways from a commercial artist wasn't it? But I hadn't given up hope. One day, some literature from Meyer Both Company fell into my hands. I read it eagerly and sent for more about the work I was interested in. I enrolled as a student. It took me nearly two years to finish the course as I kept my grocery job but, I earned, by my drawings during the course, enough to pay for it seven times. Today I'm making over \$4,000 per year and I have not reached my limit yet by any means. Is it any wonder I am a Meyer Both "booster"?

E. J. BENNETT, Parkersburg, W. Va.

You will see in reading these letters that both Mr. Hubbard and Mr. Bennett not only have greatly increased their salary but they are doing the work they most want to do.

You will find on pages 116 to 143 an opportunity to study any business, trade or profession you may have a natural liking for. Decide (Continued on page 117)

How Robert Hubbard Is Getting Ahead in the World

(Continued from page 116)

what you would like most to do and then send the coupons or write to the advertisers in the Money Making Opportunities Section who can help fit you for the job you want.

\$25 in CASH PRIZES

For the best letter of 170 words or less answering the question—

"What advertisement in the 'Money Making Opportunities Section' interests you most—and why?"

we will pay on May 10th the following—

CASH PRIZES

First Prize	\$10.00
Second Prize	5.00
Third Prize	3.00
Seven Prizes of \$1.00 Each	7.00

First read every advertisement in the Money Making Opportunities Section on pages 116 to 143. Pick out the one that interests you most and then write a letter—not exceeding 170 words—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on April 1st. The prize winners and their letters will be published in the June issue of POPULAR SCIENCE MONTHLY.

Address your letter to
Contest Editor

MONEY MAKING OPPORTUNITIES
POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York

PRIZE WINNERS in the February Contest

FIRST PRIZE \$10.00

Robert Hubbard, Little Rock, Ark.
American School.

SECOND PRIZE \$5.00

B. J. Bennett, Parkersburg, W. Va.
Meyer Both Company

THIRD PRIZE \$3.00

E. O. Greene, Gallipolis, Ohio
International Correspondence Schools

PRIZE WINNERS who receive \$1.00 each for their letters:

Harriet Paine, California, Pa.
(David B. Clarkson Co.)

Melvin L. Hopla, Keyport, N. J.
National School of Cartooning

T. W. Davey, North Vancouver, B. C.,
Canada
(Brooks Boat Co.)

D. C. Marshall, Manhattan, Kansas
Acro Shop

Oliver O. Fuller, Lincoln, Ill.
(North American Institute)

Frank G. Davis, Springfield, Ohio
(David B. Clarkson Co.)

Isabel Ebel, Brooklyn, N. Y.
Firestone Industries



Here's My Guarantee to Car Owners...

FREE GASOLINE OFFER

Save 1/4 to 1/2 Your Gasoline!

Or This Daring Trial is FREE

I Herby Hurl This Challenge at Every Car Owner in the World. Accept My Offer To Test This Amazing Device on Your Car—The Test To Be Free If Unsuccessful in Your Opinion. Read Below How It Works. Learn How You Can Make Money Full or Spare Time as My Representative. Then Mail Coupon Before Offer Expires. Many Earn

\$75 TO \$200 IN A WEEK!

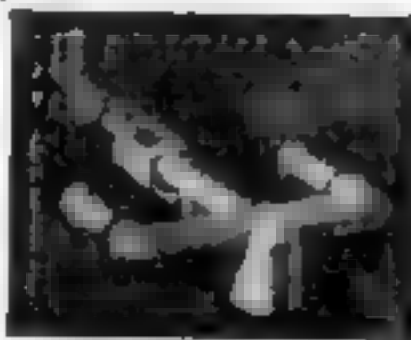
HOW would you like to run your car 1,300 miles without having any gasoline at all? That is what J. R. Wood, of St. Louis, reports. "My Oldsmobile sedan used to average only 17 miles per gallon," he writes, "but since installing the Stransky Vaporizer it has averaged better than 20 miles per gallon for over 2,000 miles."

More evidence. Out of thousands of unsolicited testimonials we have reports of increased gasoline mileage as follows: Ford 20 to 30 miles on a gallon, Star 25 to 31, Chevrolet 30 to 32, Dodge 20 to 40, Hudson 19 to 21, Overland 18 to 31, Nash 18 to 22, Hupmobile 32 to 37, Buick 17 to 22, Studebaker 23 to 27, Cadillac 12 to 18—and so on. The list is endless.

And still more evidence! Out of the over-a-million users, we have many reports from those who have had the Stransky Vaporizer on their cars for as long as three to eight years. Every day they give it the most searching test in actual operation. And still they continue to report increased mileage, more power, less carbon and engine trouble.

How It Works

J. A. Stransky, former candidate for Governor of South Dakota, is the inventor of this amazing device. It is a simple little piece of metal not much larger than a dollar coin. Anybody can install it in a few minutes. It is automatic and self-regulating. It



operates on the sound and well-recognized principle of multiplying the air power of the gasoline. Official tests have shown that most car owners waste 20 to 25% of their gas through improper combustion. But if your saving is less than 25%, you need not pay a red cent for the device.

Ends Carbon Troubles

Not saving gas isn't the only service performed by this device, according to car owners. "They say it has ended carbon and spark plug troubles," "choking" and "spitting," makes the engine start quicker and increases the power. And it provides a third service—a convenient way to remove already burned carbon, employing the same method used in cleaning out the famous Diesel engine.

How This Test Is FREE

Don't send a penny or accept anything until you find out how this device works. The coupon below will bring you full details that answer every question. Mail it now and test this opportunity to cut down the expense of running your car.

If you are interested in making money in the side or as a full-time proposition, we have a wonderful plan for you. Over 1,000,000 men have become distributors for this wonder device. Last year they earned \$100,000 in profit. No selling experience is required. Mail the coupon now without obligation.

\$48 in 3 Hours

My gas bill has been cut in half. I have removed every particle of carbon from my engine. Since I installed the Stransky Vaporizer my engine runs as good as new. A gas saver and quilter. I went out Saturday about three hours and secured 10 orders.

J. A. WILLIAMS

The STRANSKY VAPORIZER

Saves Gasoline

J. A. STRANSKY MFG. CO.,

Dept. D-738, Parkersburg, So. Dak.
Manufactures Over \$500,000 Established 10 Years

J. A. Stransky Mfg. Co.
Dept. D-738 Parkersburg, South Dakota
Yes, I want to learn full details of your offer to test this wonder device on my gasoline and carbon troubles and increase power. So send me details of your money making plan for distributors. This request does not obligate me in any way.

Name _____
Address _____
City _____ State _____

What Spell Does This Strange Book

cast over its readers?

Examine it free for 5 days. If it does not give color, charm and magnetism to your personality, return it within the 5-day period—and the examination will have cost you nothing.

YOU have had books that entertained you—books that interested you—books, even, that amazed you. But never a book like this!

Here is a book that seems to cast a spell over every person who turns its pages.

Almost every page radiates brilliant ideas. Every paragraph guides you unerringly in developing a new, dominant, powerful, magnetic personality.

A copy of this singular book was left lying on a hotel table for a few weeks. Nearly 400 people saw the book—read a few pages—and then *sent for a copy*.

In another case a physician placed a copy on the table in his waiting room. More than 200 of his patients saw the book—read part of it—and then *ordered copies for themselves*.

You can sway and control others! You can command success. You can influence people to do things you want them to do. This strange magnetic book shows how!

Once for the Wealthy Only —Now Within the Reach of All!

"Instantaneous Personal Magnetism," just completed after fifty years of research and study, is now off the press and ready for you. Edmund Shaftesbury, founder of this interesting system, devoted a lifetime to it. Such men and women as Queen Victoria, Cardinal Gibbons, Lord Beaconsfield, Gladstone, Henry Ward Beecher were among his friends and pupils.

"Instantaneous Personal Magnetism" tells how to draw people to you at once, irresistibly—how to be popular everywhere, in any society—how to be a magnet of human attraction, popular and well-liked wherever you go!

It not only tells exactly how to accomplish these things—it tells how to accomplish many of them without delay—*instantly*! How to develop your mental, personal and personal magnetism!

Shaftesbury's amazing science of magnetic



control was at first confined to the use of those wealthy few who could pay from \$200.00 to \$500.00 for the scientist's private instruction.

With the publication of "Instantaneous Personal Magnetism," Shaftesbury's complete method of magnetic development is within the reach of everyone. Everything that he taught on the cultivation of personal magnetism is in this one authentic book. It will show you how to awaken your creative energies and set free your great thought force and magnetic self!

—and watch yourself become more and more successful, popular.

Give verve, color, magnetism to your personality—and see what a difference it makes in your life! The drab, colorless personality is a handicap; the irresistible, dynamic, compelling personality cannot fail to be recognized and respected in every society and under all circumstances—in your business, your profession.

Instantaneous Personal Magnetism—Now Yours!

The principles that Edmund Shaftesbury taught to those famous men and women—and for which many paid as high as \$500—have been brought up to date and the new revised edition can now be yours—for less than the cost of an ordinary volume. Imagine it! Edmund Shaftesbury's whole astonishing principle of magnetic control to apply to you—your personality and use in your daily contact with people!

Mail Coupon Today For 5 Days' FREE PROOF

If you want a compelling personality—if you want magnetism, new power, new strength—send for "Instantaneous Personal Magnetism" at once. Mail the coupon today this remarkable volume, bound in handsome dark cloth and gold, embossed, will be sent to you at once for a 5 days' FREE examination.

If you are not thrilled and inspired by this amazing book, just return it within the 5-day period, and the examination will have cost you nothing. Otherwise keep it as your own and send only \$3 in full payment. Clip and mail this coupon. NOW! Before you forget for the most magnetic book you ever saw! Ralston University Press, Dept. 14-H, Meriden, Conn.

RALSTON UNIVERSITY PRESS,
Dept. 14-H, Meriden, Conn.

You may send me "Instantaneous Personal Magnetism" for a 5-days' free examination in my own home. I will be the judge. Within the 5-day period I will either remit the special low price of \$3 in full payment or return it without cost or obligation.

Name _____

Address _____

City _____

State _____

What Personal Magnetism Is

Personal Magnetism is not necessarily inborn. It can be cultivated, fostered, until it becomes a natural part of you. Your eyes, hands, lips, voice, bearing—all radiate personality of an individual kind. All lend themselves to the one great fundamental quality known as *Personal Magnetism*.

Strange Effect on Readers

Readers of this book quickly become masters of a singular power to attract others—to influence men and women around them. Not by force—not by loud argument. But rather by some subtle, insinuating power that sways men's minds and emotions. They are able to play on people's feelings just as a skilled violinist plays upon a violin.

Folks are rarely the same after reading this book. Their manner changes. The tone of their voice, the expression in their eyes—yes, even their actual features seem to change—seem to grow more cultured, more refined.

Release this dormant magnetism within you

What Grateful Readers Say

"I am indebted to Shaftesbury for all that I am in this world."

Made me a success financially socially and morally.

I would not give up what he has taught me for \$100,000.

A Twin Service

for Ambitious Men

T Training
Preparing you for a better job and a Raise in Pay

E Employment
Placing you in a good, well-paid Position



O. C. MILLER
Director Extension Work

A Million Dollar Institution Back of This GUARANTEE

Get this straight—the American School was chartered in 1897 as an educational institution not for profit. So you will find the same standards of service here as in the best residential schools and colleges. Over 200 of the leading Engineers, Executives and Educators of the U. S. prepared the instruction we offer. Their standing touches for its quality. This is a little to you on terms of only a few dollars a month. If not for our souvenir book, "Life Magic" given free in celebration of our 30th Anniversary.

Free Job Service

The American School is the first in the home study field to guarantee the level of guaranteeing its students with a money-back guarantee. If the training fails to accomplish the benefit you expect, this all money-back guarantee is yours. The training will help you to a better job and a raise in pay or it will cost you nothing. To help you carry out this guarantee we have maintained a National employment department which keeps in touch with the employers of Draftsmen all over the U. S. A. but without extra charge to our students and graduates.

If You Are Now Earning \$40 a Week or Less —

I guarantee to prepare you for a fine Drafting position, right in your home in your spare time. Then I guarantee to help you find such a position paying at least \$50.00 more than you earn today, within 60 days after you complete this training, or I will refund the small amount you pay for tuition. We make this agreement to prove this instruction will make you a *real draftsman*. Back of this guarantee are the entire resources and reputation of this million dollar institution.

O. C. Miller

Go into Drafting!

Learn Drafting—how to make and read plans, and the doors of opportunity in all mechanical, building, and engineering lines swing open for you! There are more well-paid Drafting jobs open today than in any other one profession or trade. There's a variety, a fascination to Drafting that will grip you. No other work is so interesting, so well paid—no other field offers equal opportunities for quick promotion.

The Draftsman is the Boss of the Works!

Destroy blue-prints and plans, and the wheels of all Industry will stop until new ones can be made. Every move of every workman on the job is controlled by the Draftsman through his plans. Railroads, public works, buildings of a hundred sorts, machinery, electricity, automobiles—all manufacturing and construction start on the Drafting table! That's the kind of work to get into, friend. Where you have the same chance as anybody else to make a quick success!

—to prove you can learn at home in spare time!

You'll be surprised how quickly you can learn Drafting by our new one-step-at-a-time method. We start you off doing actual Drafting room jobs from the very beginning. Before you know it, you are battling out professional plans like a veteran. Get the first three lessons—the coupon brings them. Do them. Test your ability to master Drafting at home. Without cost or obligation.

O. C. MILLER, Director Extension Work
American School, Dept. D-475
Drexel Ave. and 58th St., Chicago

Your offer to send me 3 lessons free and facts about the opportunities in Drafting and about your course, looks good to me. It is understood I am not obligated in any way in making this request.

Name _____

Street No. _____

City _____ State _____

3 Drafting Lessons Actually FREE

Professional Outfit GIVEN!

You will naturally expect the American School to give you the best kind of instruments and tools with the best kind of training. This outfit is good enough to use professionally after you finish your training. Mail coupon for description.

O. C. Miller, Director Extension Work



The American School

Dept. D-475 Drexel Avenue and 58th Street, Chicago

STEAK 2100 is a very selling product in Prime Steaks, the
most of a thousand types. I imagine with ten-fold value
it is to be very profitable in all, especially with them
ought to have some of the quality of its surface, as a
trouble lamp, emergency head or an light etc. Prime 21
is a staple of the 22 for example. Many customers
with 10 days of disaster relief. Multiple types of Prime
of its or more. National Electric Products Corp. 5 N
Central St. Newark, N. J.

COUPON → **FRANKLIN INSTITUTE.**
Dept. G-266, Rochester, N. Y.
I wish to receive without charge
a 3-month trial copy of
"The Franklin Institute Course"
and to receive a 3-month trial copy
of "The Franklin Institute Course"
and to receive a 3-month trial copy
of "The Franklin Institute Course"

Name _____
Address _____

Play "JAZZ" on the Saxophone

Become a musician so quickly as to surprise everyone. Learn to play the saxophone in the most popular person to your ear.

New Easy Method

Nothing else like it for horniness and rapidity. He attains the playing and the sound in play with amazing speed. No trick music. Just actual music. Instantly quickly right in your own home.

FREE BOOK and

Demonstration Lesson offers the wonder in musical opportunity. Send for them today before opportunity is lost. You will be surprised at the easy rapid way to learning a popular melody of our time. In your own home, no instruments required, when you wish.

U. S. SCHOOL OF MUSIC
24 Brunswick Bldg. N. Y. City
Send me your amazing free book. I will learn to play in my home. It is introduced by the best of our time. This does not put me under any obligation.

PICK YOUR INSTRUMENT
Harp Violin
Organ Clarinet
Lute Flute
Concert Piano
Trombone Cello
Saxophone Piccolo
Mandolin Guitar
High Singing
Voice Accordion
Voice and Speech
Cello
Harmony and
Composition
Drums and Traps
Automatic Player
Control
Banjo Tenor
Plectrum or J-String

Name _____
Address _____
City _____ State _____ Zip _____

PREPARE FOR AN ART CAREER

—thru the only school operated as a department of a large art organization. Commercial Artists trained the "Meyer Both Way" earn as high as \$10,000 per year. We today have hundreds of students who had previously studied in other art schools. Why? Because your instruction is based upon our everyday experience in meeting the art needs of leading advertisers. Home study instruction. Write for illustrated book telling of the success of our students.

MEYER BOTH COMPANY
Michigan Ave. at 20th St. Dept. 15 Chicago, Ill.

Agents—Salesmen

Patented Cigarette and Match. Holds a package of 4 figure boxes of safety matches. Made in flash black leatherette. A retail seller at 75c. Costs \$1.60. \$1.60 gross. Write for particulars on liberal profit proposition.

ALL-IN-ONE SALES CO.
Dept. 2-4, 2310 Portland Ave. Minneapolis, Minnesota

SAMPLE 50c

Wanted—Cartoonists!

Increasing demand for cartoonists means big money for the right man. The big money is in the hands of the few who are in the right place. Write for details. Send me your resume and samples. I will send you a copy of my book "How to Get a Cartooning Job".

Wanted—Cartoonists!
M. Rosenberg, Room 4, Artists Bldg., Cleveland, Ohio

Learn to Mount Birds

Learn at home to mount birds, not rats, game heads, etc. Full, quick, easy, and reliable. Complete lessons. Early and quick. Send me your resume and samples. I will send you a copy of my book "How to Get a Mounting Job".

FREE Write for Free Book. Tell me about it. I will send you a copy of my book "How to Get a Mounting Job".

Learn to Mount Birds
Write for Free Book. Tell me about it. I will send you a copy of my book "How to Get a Mounting Job".

Don't Blame Your Radio Set

(Continued from page 4)

press, it appears that Congress will pass a radio bill that is a compromise arrived at by the Senate and House conferees. Embodied in it are many of the important provisions of both factions. Unless further amended, the bill will provide for a commission which will have full control of radio broadcasting for one year, after that control will be vested in the Secretary of Commerce with a commission to decide disputes and protests. An appeal to the courts is provided as a last resort.

But you, as a radio fan, cannot expect immediate relief from the present intolerable interference. Even if the bill is passed without further delay, it will take time to organize the commission, and the commission will have to make a careful and comprehensive study of the situation before taking any definite action.

But no matter what system of control is installed, there will be two grave problems that must be settled before order can be brought out of the present radio chaos. One is: How many stations shall be allowed to broadcast? The other is: Which stations shall be compelled to close down?

As a radio listener, you undoubtedly have formed some very definite opinions on these two important questions as they apply to the broadcasting stations that are received with regularity in your section of the country.

Which stations do you want to continue broadcasting? Which, in your opinion, should be shut down? If you care to write a letter to **POPULAR SCIENCE MONTHLY** incorporating your ideas on this important matter, we will be glad to forward them to whatever controlling agency Congress establishes.

New Publications

Romance in Science, by Prof. Beane I. Miller. The Stratford Company. There is a Fourth Dimension in Mathematics, but that does not prove there is a Fourth Dimension in Spirituality, and Einstein does not claim it does, this writer says. Neither does he claim that there is an actual Fourth Dimension in the physical sense that can be felt and smelt and seen. The magazine humorists are off the track, and are joking without their premise.

Wild Birds in City Parks, by Herbert Eugene Walter and Abner Hall Walter. The Macmillan Company. The book tells how to stalk and identify birds without putting salt on their tails, describes 203 species to be found in city parks, and gives all manner of tables concerning their appearance and habits.

Brains of Rats and Men, by C. Judson Herrick. Professor of Neurology, University of Chicago. The University of Chicago Press. This book reverses the usual process of tracing human faculties backward to the animals and traces them forward from animals to men, taking especially the brains of rats and men to prove that the cerebral cortex has evolved.

Are You Hungry For Adventure Popularity Big Pay?

THEN CHOOSE AVIATION!



ARE you a red-blooded, daring ha-man? Do you crave adventure, popularity, admiration, and the applause of great crowds? Then why not get into the Aviation Industry—the greatest adventure since time began—the greatest thrill ever offered to man?

Think what Aviation offers you. The prizes and plauds of the multitude. Ordinary salaries up to \$75 and better than \$200 a week! And a chance to get in on the ground floor where rewards will be unlimited! Aviation is growing so swiftly that one can hardly keep track of all the astonishing new developments. Air-mail routes have just been extended to form a vast aerial network over the entire U. S. Many Commercial Airlines and airplane factories are now being organized. Men like Henry Ford are investing millions in the future of commercial Aviation for they see its great possibilities.

Become An Aviation Expert!

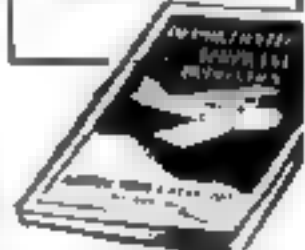
Get into this thrilling profession at once while the field is new and uncrowded. Now—by a unique new plan—you can quickly secure the basic and preparatory training you need to get started in the Aviation Industry at home, in spare time. Experts will teach you the secrets and fundamentals of Practical Aviation—give you all the inside facts that are essential to your success. And, the study of Aviation by this remarkable method is almost as fascinating as the actual work itself.

Send for FREE Book!

Send coupon for our new, free book just out: "Opportunities in the Airplane Industry." It is a really interesting, reads like a romance and tells you things about this astonishing profession you never even dreamed of. Write for your copy today.

BIG PAY JOBS

Instructor
\$10 to \$150 per Week
Engineer
\$100 to \$200 per Week
Constructor
Extensive Profits
Repairman
\$50 to \$75 per Week
Mechanician
\$10 to \$50 per Week
Inspector
\$10 to \$15 per Week
Mechanic
\$100 a Year and Up
Assembler
\$10 to \$25 per Week
Painter
\$10 to \$20 per Week



AMERICAN SCHOOL OF AVIATION
3401 S. Michigan Ave., Dept. 1344, Chicago

AMERICAN SCHOOL OF AVIATION
3401 S. Michigan Ave., Dept. 1344, Chicago, Ill.

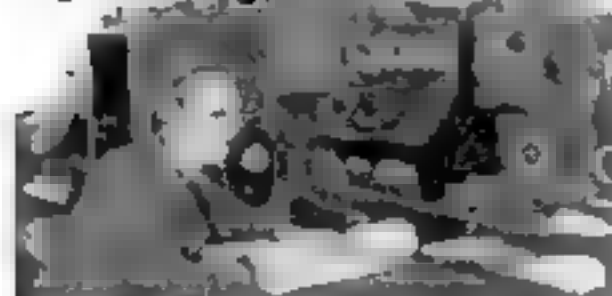
Without any obligation, please send me your FREE Book, "Opportunities in the Airplane Industry." Also information about your course in Practical Aviation.

Name _____

Address _____

City _____ State _____

See the World FREE!

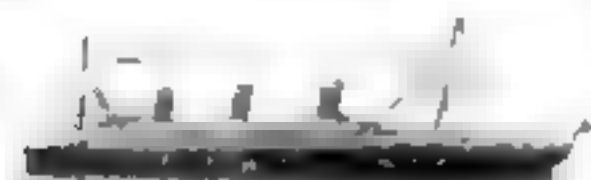


Taste Romance and Adventure In the Far Lands of the Earth

How often you've longed to see for yourself the awe of Egypt's pyramids—the beauty of the gorgeous Mediterranean sunset—the squalor of China's ancient cities!

Spend a few years, or the rest of your life, tasting high adventures in the seven seas and in all the world's great ports—visiting the earth's highways and byways! You can do it! All at your expense paid—and earn a good salary besides!

Only one profession will carry you around the world at will, traveling like a gentleman, but this is the most interesting and pleasant work there is—Radio Operating. Easily and quickly learned, there is no other profession like it for the man who wants the excitement and pleasure of world-travel. Radio operators are needed—on all sea-going ships like the one shown here must carry from one to half a dozen or more.



Take a Look Beyond the Skyline Without a Penny's Expense

Radio operators aboard ocean liners live luxuriously—they rank as officers of the ship. Meals, a private cabin, and other living needs are furnished free, and besides the operator draws a good salary. You can learn quickly and easily at home in your spare time to be a Radio operator through our practical training methods. Take a look at the FREE BOOK which tells how—mail coupon below.

This U. S. Government-recognized school has been training successful operators since 1914. Our graduates are all over the world. We maintain an Emergency Department on our ship in your own ship. The world knows NATHANIEL, our own patented invention, obtainable only by students of this institution, is recognized as the best and most direct way to learn the Radio code. A few short months with the aid of the famous Natrometer and our quick home training, and you too can be a fully qualified Radio operator, sitting in your cabin like the one shown above, bound out for Liverpool or Nagasaki!

Read the Free Book that tells all about this fascinating profession and our practical Government-recognized methods of training you for it. Send coupon TODAY—an obligation. Special training offer now on, includes world-famous Natrometer free of extra cost with your course. Act at once.

NATHANIEL RADIO INSTITUTE
WASHINGTON, D. C.

SPECIAL OFFER COUPON

Nathaniel Radio Institute,
Dept. D-57, Washington, D. C.

Gentlemen: Without obligating me in any way send me your free book and information about your offer of Natrometer with course.



World-Famous
Natrometer

Name _____

Address _____

Marvels of Scaffolding

(Continued from page 30)

the foundations, huge mechanical mixers preparing concrete for caissons and retaining walls, towering derricks lifting steel beams and setting them in place, and daring structural workers scampering over the beams, bolting and riveting them together. Seldom, however, do we realize the enormous task involved in clothing the steel skeleton with walls. Yet this problem, perhaps more than any other, heretofore has limited the height to which buildings could go. It has been solved at last, only after a struggle between American engineering ingenuity and the laws of gravity.

With the first true steel skyscraper, a score of years ago, there developed, almost overnight, a new race of working acrobats. Without staging, often without even a ladder, they rode the beams and columns flung around by derricks, and worked with a speed and daring which would have made our tree-climbing progenitors gasp.

BUT the veneer of brick, stone or terra cotta could not be placed so easily from inside. Speed and economy of labor required that every square inch of the building exterior must be reached easily by human hands. Staging built up from the ground for heavy materials and many men, might serve the purpose up to a height of some six stories, but beyond that point the forest of timbers became too heavy, the cost excessive, and the hazards out of reason.

Many schemes were devised. The block and tackle was discarded early, for the hazards of rope, weight, knots, and so on, were too great. Hundreds of mechanical contrivances were built, tried and scrapped, and many accidents occurred. But finally, out of the human laboratory there emerged principles and designs that brought into being our great towers of industry.

As early as 1910, the hanging scaffold demonstrated its safety. Fifty workmen, busy on a suspended platform over the great plaza of the Grand Central Terminal in New York, escaped unscathed when a terrific gas explosion went off directly beneath them, killing twelve and injuring more than a hundred men working in other locations. And by 1914 this type of scaffolding had become so reliable that the walls of the Woolworth Building were erected without the loss of a life.

TODAY the suspended scaffold is so secure that even if one or two of the wire cables should snap, the platform and its load would not fall. The planks are overlapped in such a way that if a cable gives way, they will lock together and support themselves!

The method of operating the trapeze scaffold, like the machine itself, is typically American. A number of large concerns supply "scaffold service" to builders. Each employs a force of skilled riggers, builds and rents equipment, installs, inspects and maintains it in good condition.

The time-rental basis undoubtedly

leads to economy and rapidity of erection. Perhaps the greatest economy lies in the fact that the new scaffolding can be quickly changed to a new elevation without interruption of work. With stationary scaffolding, it was necessary to move workmen and materials from the platform before its position could be changed. This meant loss of time, with a corresponding increase in cost of construction. Now, however, the hanging platform can be raised quickly with a few strokes of a lever which winds the strong steel cables on the hoisting drums. If the work requires, one end of the platform may be fixed several feet higher than the other.

A recent development which has done much to facilitate high construction is the architectural design of skyscrapers providing for a succession of steps or setbacks, beginning twenty to forty stories up, each of which serves as a working ledge from which materials may be passed on to the next ledge. By this method, there is virtually no mechanical limit to height, for the hanging scaffolding can be raised indefinitely.

BRIDGES, with their great steel and concrete arches, also have taxed the ingenuity of scaffold experts. Sometimes the bridge must span a chasm where falsework is out of the question. In Brazil, for example, a suspension bridge with a main span of 1,114 feet recently was erected without the use of any falsework whatever. By ingenious methods the main cables were employed to carry workmen and materials.

The scaffold cost may make or break the bridge builder. Not many years ago expert designers on the great Hell Gate bridge in New York fairly outdid themselves in eliminating the last unnecessary pound of steel in the structure. But they neglected the question of falsework design for the unusual type of bridge they evolved. As a result, the greatly increased cost of erection considerably more than absorbed the saving in steel.

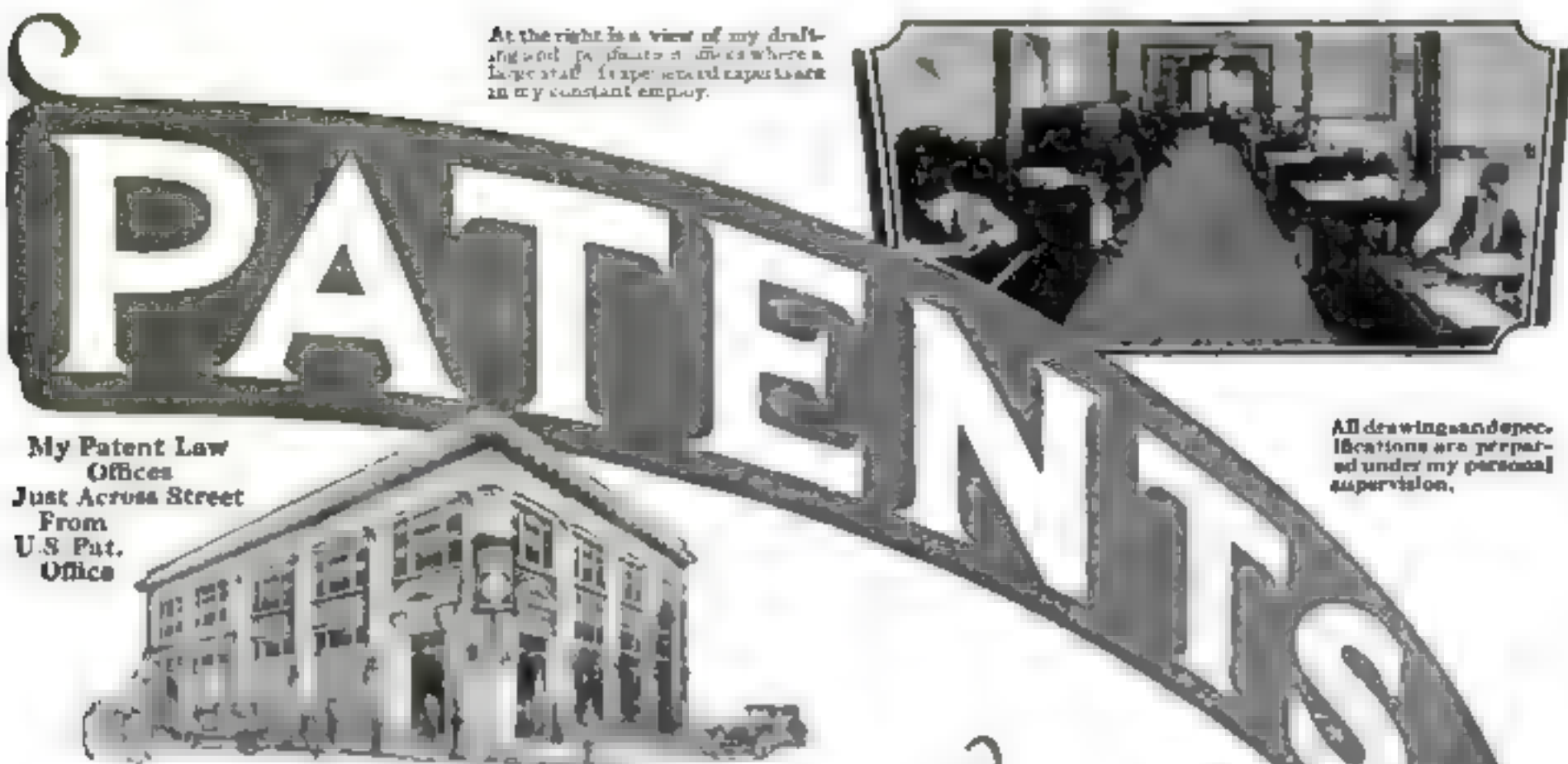
The scaffold expert also plays an important role when high chimneys, power plant stacks or church towers are to be built. Every job offers a different problem. In the past it has been necessary often to erect staging the full height of a stack or tower, both inside and out. Here, again, the hanging platform is doing much to simplify the task. For example, a great building in New York will have a ventilating stack 375 feet high, and every square foot of its inside surface is being plastered from suspended scaffolding.

HERETOFORE not a little of the cost, as well as the hazard, of scaffolding has been in its removal. Wooden staging, such as church towers and hoists have required, must be taken down slowly and carefully, beginning at the top. Considering that stagings for 400-foot church towers, and 500-foot hoist towers, have been erected, the task is a long and tedious one. Again the advantages of the new "trapeze" methods are obvious.

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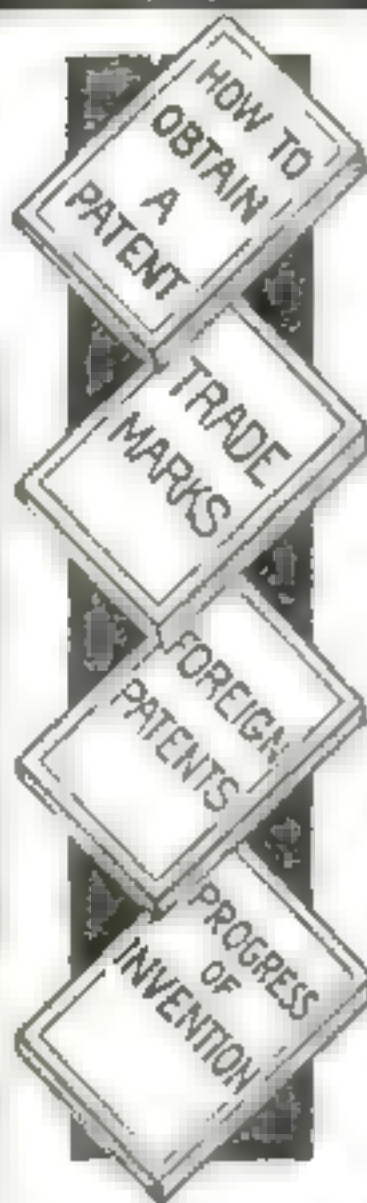
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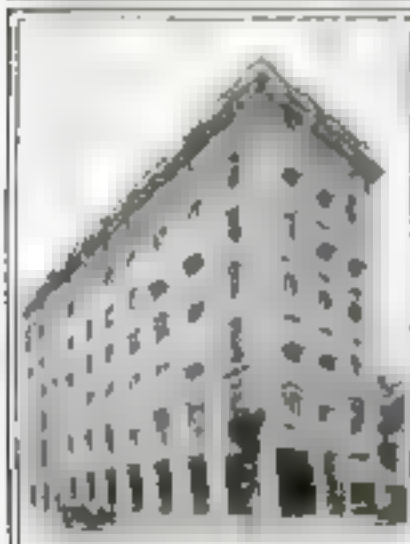
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[illegible]

What Does Your Garage Cost You?

(Continued from page 131)

where no central pillars with steel beam are required. There is a continuous self-supporting slab with bearings on the side walls, which should be masonry. It is convenient to make the concrete floor first, so as to have a firm and even bearing for roof form supports. The latter may be ordinary studs spaced three feet apart, upholding edgewise two by fours which are spaced at two-foot intervals. Then lay a light flooring of one-inch shiplap boards, using small nails for ease of later removal. It pays to paint the boards on both sides before placing with any kind of oil, including used engine oil. This prevents warping and makes a smooth ceiling. The form may be built level, since the upper surface of the concrete can be straightened to the slight slope required.

THE reinforcement should extend over three-fourths of the width of the bearing walls and should be within an inch of the slab bottom. If one side is the house wall, it is safer to build a horizontal reinforced beam on that side than to depend on drilled holes with metal roof rods grouted in. Metal may be kept off the form bottom by bits of shingle lath and by a first layer of grout or liquid cement. Remove some of the lath pieces as the material stiffens. Any that remain can be chiseled out of the ceiling later and the spaces filled with cement.

Tables made by metal and cement makers eliminate guesswork as to the amount of reinforcement needed. It is easiest to use expanded metal or wire mesh that is specially designed for a given span. But where such material is not available it is all right to use half-inch rods of round section or the equivalent in square. For a span of eleven feet, space these bars eight inches apart and make the slab four and one half inches thick. For a span of twelve feet the bars are half an inch closer and the slab is five inches thick. Another foot added to the span calls for seven-inch spacing of rods with half an inch added to slab depth. At fourteen feet the slab is no thicker, but the rods are six inches apart. To prevent temperature cracks, cross the rods with a medium weight of new wire fencing.

TOO many garage doors are flimsy and of the hinged out-swinging type. It is better to have doors that fold or slide inward, being suspended from above. Track, rollers and other fittings may cost around fifteen dollars. Doors in three leaves hinged together are suitable, one leaf making a convenient service entrance. The best doors, which need no braces, are double thick one-inch tongue-and-groove boards, the outside vertical and the inside horizontal, with inside screws holding the two layers together.

Mr. McMahon's services are available to our readers to assist them in solving their building problems. Letters will be answered free of charge. Address John R. McMahon, POPULAR SCIENCE MONTHLY, 259 Fourth Avenue, New York City.

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New Wings for Your Voice

(Continued from page 11.)

would encircle the earth twelve times, and their "talk-capacity" is steadily being increased. The multiplex system sends four messages at a time in each direction over a single wire. At the rate of fifty words a minute this means that a single line has a capacity of 5000 messages a day, as compared with an average of 480 by hand sending. Each message as it is received is printed automatically on a tape by a teletype machine. Electric typists rapidly write uncanny messages, apparently from nowhere, their unseen fingers pressing the keys, shifting the carriage, and spacing the lines.

THE sea, the air, and the land are teeming with messages from man to man. Today two thirds of a million words each day flash by the sunken treasures of the Atlantic's deeps. Half as many more ride the same route by air on man made radio lightning.

In the air regions closer to earth, aviators are now able to intercept and transmit electric-wave messages. They converse with brother pilots in the sky, and with their friends on the ground. Similar messages guide their course in night flying. For this a directive radio antenna has been devised by the U. S. Army and Bureau of Standards. As long as the pilot stays within the narrow lane of his course, he receives a continuous signal in Morse code, when he deviates, he receives either the letter 's' or 'n', which tells him toward which side he has drifted.

Through the earth itself, waves of sound and electricity carry messages. Underground sound waves can be picked up by an instrument called the geophone, a form of microphone. During the war this device enabled listeners to detect enemy mining and sapping as far away as a hundred feet. On one occasion Allied sappers, working their tunnel to within six feet of a party of German sappers, listened to the talk and laughter of the enemy before exploding the mine. More recently the geophone has aided in mine rescue.

IN WATER, too, waves of communication travel. Suppose I suspend a submarine bell under my boat while you, from another boat a mile distant, listen through a hydrophone (a seagoing microphone) for the sound of the bell. In a little more than one second after I tap the bell you will hear the signal. This is about five times as fast as the sound waves would travel in air. You may even hear one of the "drumming fishes" with your hydrophone. Fishermen have heard the sea robin and other fishes at a distance of a hundred feet or more.

If our boats were out on the ocean, separated by fifty miles of rolling waves, you still could hear an explosion set off near my boat. If we both were equipped with phones, and were a hundred miles apart, each of us might hear an explosion two hundred miles away from us, and might even locate its position within a

half mile. This has been done. Again, if you should become lost in the fog, I could pick up the vibrations of your propeller. You in turn, could avoid reefs by listening for submarine bells along the rocky coast.

Lighthouses and shore stations would give you regular signals, some of them utilizing the time difference between the speed of radio and sound waves to give you the exact mileage to the station. Should you approach the coast near Calais, France, you might use special equipment to pick up enormous waves of "inaudible sound" sent out by a great lighthouse established there. Such sound vibrations are beyond the range of human ears. And all this time I could keep in touch with you by radio.

SO, IF you were in distress, your rescue would be far simpler than was that of the steamer *Republic* in the first wireless rescue at sea. You recall that the *Baltic* caught her CQD, the wireless distress signal of that time, that she was sinking after a collision. For twelve anxious hours the *Baltic* searched the dense fog, constantly wirelessly, but was forced to cover more than 200 miles in a zig-zag and circling course within an area ten miles square, before she could work up to within a hundred feet of the *Republic*. Even then the stricken vessel was invisible, but finally the faint green light of a flare was picked up, and the rescue effected. If the *Republic* had carried a submarine bell the rescuing ship could have gone to her directly.

Above the ocean surface, likewise, the waves of modern communication safeguard the lanes of commerce as never before. Out on the Atlantic roam the ice-patrol boats, radiating the presence of icebergs, that no more Titanic disasters may occur. Great liners carry microphones to catch the echoes of sound waves reflected by the floating ice mountains, much as the sea floor is mapped by the sonic depth finder. Some vessels also carry "thermopiles," delicate thermometers which measure waves of heat and cold. One such device measured the heat radiated from the funnel of a vessel seven miles away! Weather reports, too, are radioed.

WHAT does the future hold? Crime waves are yielding to electric waves, for recently a well-known pickpocket was identified two minutes after his photo was wired from Chicago to New York. Thief detectors now indicate the presence of smuggled tools and metal objects.

The radio motion picture is close at hand, and with it will come marvelous extension of education and home entertainment. Newspapers will one day print the entire important news of the world, with photographs, the same day it happens. Television apparatus in your home will depict the world of music, the dance, opera, and sport.

Devices nearing perfection render these prophesies simple statements of developments to come within our own time.

Are You Afraid to Face the Truth About Yourself?

There are occasions in the life of every man when he realizes how miserably he has fared below what others have expected of him and what he is treated for himself. The only man faces the truth. He does something about it. He is not a man who is an excuse for his failure, and does not. What are your answers? You ask yourself questions like these:

Am I not drifting along aimlessly?

What, after all, is my purpose in life?

Am I trusting too much to chance in being successful?

What is my greatest weak point?

Is it lack of will, poor memory, mental laziness, mind-wandering, or what?

Am I "licked" by life, am I a "quitter"?

What can I do, now, to "And myself"?



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I Catch My Wild Beasts by the Tail!

(Continued from page 147)

yelps rolled up out of the dirt, then out burst the hog, scattering us in all directions. One of the dogs was impaled on a tusk, but the hog shook it off and disappeared in a mass of thorns.

There the dogs cornered him. When we arrived on the scene, breathless and torn by thorns, we saw the boar backed against a tree, with a circle of dogs snarling and snapping at him.

"THREE of you boys sneak around behind," I directed. "I'll go up in front and get his attention. While he's watching me you grab one of his hind legs and roll him over."

Catching sight of me, the wart hog, disregarding the dogs, charged straight at me. Thinking that one of my boys would grab a leg, I let him come.

And he came! I jumped just in time. The hog almost gored me. Straight up in the air I went, the hog rushing under my widespread legs. As I came down I performed a feat any contortionist might be proud of. Bending double, I caught one hind leg of the beast, and with a jerk threw him on his back.

Grab him! I shouted above the din of squeals and yells. "Hold his head—tie up his snout. Now his legs!"

In a minute the boar was our prisoner. He proved to be about three years old, with tusks projecting five inches.

Animal catchers at least have plenty of variety in their lives. If we're not after such easy things as pythons, or having fun chasing wart hogs, we try bagging something bigger—elephants, for example.

The capture of Yank, a beifer elephant about six years old was a typical example. Harry and Mackie Walker and I had been trailing a certain herd of elephants near Choma for several months. We had managed to bag two—a "tiny" baby still drinking milk and yet to cut its teeth, and a bull standing about four feet and a half high.

The third time we got up to the herd we found them feeding. From the top of an ant hill we looked them over for a good calf. Yank, lying beside her huge mother, looked about right.

HARRY fired, but failed to kill the cow, which rushed off with the rest of the herd. The pack of dogs, some fifty of them, took after Yank, however, and cut her out from the rest. Then, while the dogs were fighting with Yank, and we and our natives were yelling encouragement from our vantage points on ant hills and in trees, the big cow suddenly returned. She had come back in response to the calf's trumpelings of rage and fear.

The old cow made straight for a bunch of natives atop an ant hill, where stood the aged Schamasas, an elephant hunter of long experience. We could see him motioning the boys to stand their ground. Then the cow charged, ears out, trunk dangling wickedly, tusks shining dirty white in the sunlight. Quick as a flash, Schamasas let fly his long elephant spear. It struck home between the elephant's

shoulder and neck, the razor blade sinking deep. The cow backed away, screaming, as if she had been hit with both barrels from a .600 express rifle.

MEANWHILE, Yank was proving too big for the dogs. They couldn't play her out. And no man dared chance a run on the ground, for the calf was breaking trees ten inches thick like so many matchsticks. Finally she escaped and disappeared.

Several times after this we got up to the herd, but each time Yank was missing. And when at last we did find her, she was very weak and thin. She must have been wandering alone for days. Again we cut her from the herd, but this time she did not stop to fight. Instead, she struck off through the bush, with white men, natives and dogs in hot pursuit. Reaching the Choma river, she swam across, and on the opposite bank turned to fight.

All afternoon, in the intense heat, she fought the dogs off. But toward evening she began to tire. She drew water from her stomach and sprayed it over her head. After another hour of fighting, this gave out and she stood throwing sand and dirt over her head and back.

FINALLY one native, braver than the first, got her by the tail. Yank whined, but the native hung on desperately. Then she charged off, dragging him for some hundreds of yards, until he was forced to let go. Mackie was the next to take a chance with the tail. He clung grimly. Harry and I, sliding to the ground, motioned the boys to come on. They came in a mob, and a moment later Yank was buried in a sweating, grabbing, tying crowd of whooping blacks.

Three days after Yank's capture, she allowed us to ride her. She fed quietly and behaved respectfully. An elephant is much too intelligent to fight after it once understands that it cannot win, and after it sees that it will be treated kindly if it obeys orders.

Life Chemically Imitated

MAN'S nearest approach to artificial creation of life has been reported by a French chemist, M. Herrera, of Paris. He created chemical droplets which behaved outwardly exactly like the single-celled amoeba, lowest of animal forms. They moved from place to place, formed vacuoles within themselves, and divided, for all the world like unicellular, living creatures.

The droplets were produced by dissolving fourteen parts of caustic soda (lye) and one part rhodanum (a brilliant red dye) in 100 parts of water, and adding a few drops of this to a second solution of one part olive oil to two of gasoline.

The French savant explains that the resulting action, while of great interest, has no actual connection with life, which still defies the science of chemistry to create it. His own phenomena, he said, are due to physical and chemical causes.

When Your Wife Drives

(Continued from page 142)

you'll realize how important it is to get steering so pat that it is instinctive. While your brain is occupied with figuring out the right way to go through the motions of gear shifting, the steering has to go on just the same.

"Learning how to back up is a point that many otherwise good drivers neglect. Whoever is teaching you how to drive ought to take you out on a road where there isn't any traffic, to teach the gear shifting; and don't kick if he makes you back up a whole lot. Practice is the only way you can get to know how to handle the steering wheel when the car is going backward.

"MOST women don't want to know anything about what goes on underneath the hood or the floor boards, but you ought at least to learn how to change a tire without help. And you should know enough about the oiling system to tell whether the motor needs oil or not. Also, you ought to know how to read the gasoline gage and the radiator thermometer."

Joe Clark, who had been busy with another customer, strolled over at that moment.

"Here comes a teacher for you," smiled Gus. "Joe is a swell teacher—even if he does clash gears once in a while!"

First Beauty Parlor

(Continued from page 32)

ences direction and velocity of the winds in the different parts of the cyclone at the earth's surface. By bringing about the convergence of winds, this current determines largely the distribution of precipitation in the cyclone and causes its center to move toward the greatest precipitation.

The book is filled with maps and tables that bespeak infinite capacity for taking pains, so essential in the work of the writer, who is senior meteorologist of the U. S. Weather Bureau.

"The Anatomy of Science"

By Gilbert Newton Lewis
Yale University Press

EVERYBODY who has a dog, talks to him. Some confide their secrets, some simply say "Go lie down." It may surprise them to know that to this scientist, at least, it seems hardly likely that the man can talk to the dog any more effectively than the dog talks to the man.

"Of the various desires that I might wish to communicate to my dog, he can understand about half a dozen," he says, "and can make me understand about the same number of his own."

In fact, he doubts whether, judged by any objective criterion, the intelligence of man is supreme. Our Cro-Magnon ancestors were not comparatively so simple after all, he says. If we defined intelligence as ability to meet successfully situations of an entirely new character, he thinks, it is generally conceded that modern man is no more intelligent than the Cro-Magnons.

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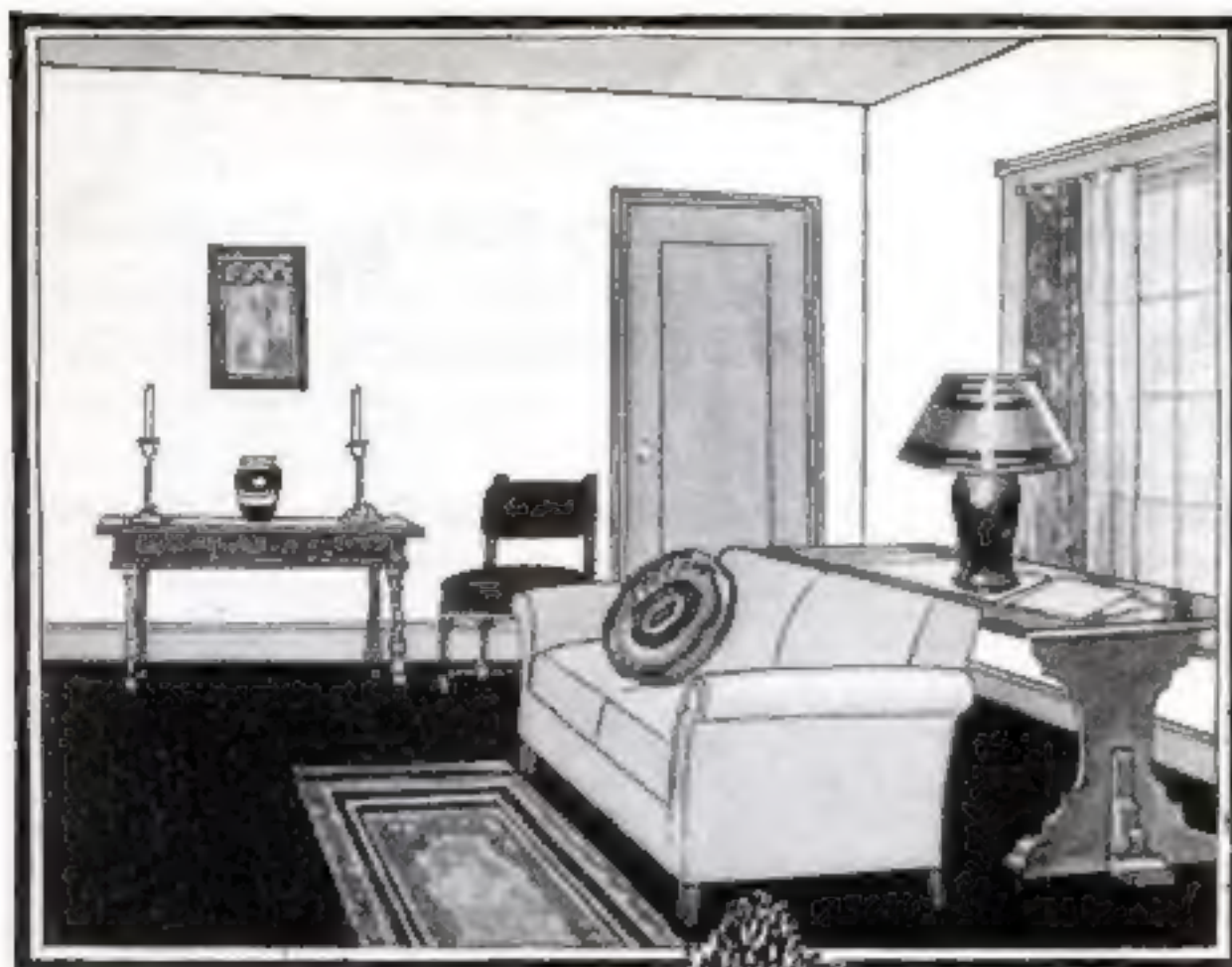
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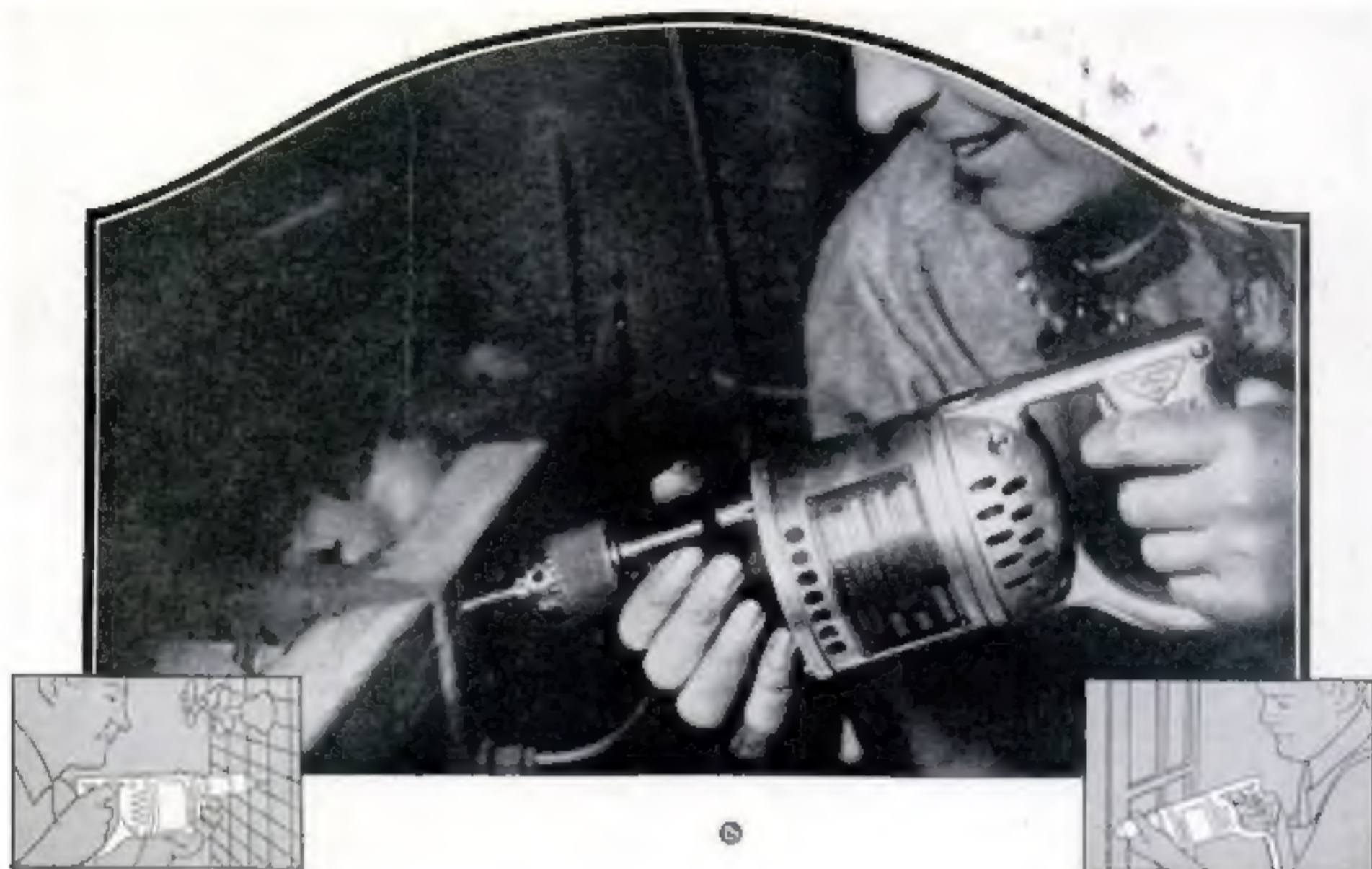
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